PROCEEDINGS

WORKSHOPS ON

STRATEGIES IN AGRICULTURE SECTOR FOR NUTRITIONAL GOALS

Padmasini, Asha

AND

NUTRITION EDUCATION-COMMUNICATION MATERIALS, MEDIA AND AGENCIES

SPONSORED BY
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Proceedings of Workshops on

STRATEGIES IN AGRICULTURE SECTOR FOR NUTRITIONAL GOALS

held at the

NATIONAL INSTITUTE OF NUTRITION

Hyderabad - 500 007

July 21-22, 1980

and

NUTRITION EDUCATION - COMMUNICATION MATERIALS, MEDIA AND AGENCIES

held at the

COLLEGE OF HOME SCIENCE

Andhra Pradesh Agricultural University

Hyderabad - 500 004

July 23-24, 1980

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PREFACE

The developing countries are today facing a multitude of problems, socio-economic and otherwise. But malnutrition is perhaps the most vexing problem with far-reaching implications. What is intriguing is the rather paradoxical situation prevailing, which can best be described as poverty amongst plenty.

Resources, both human and material, are aplenty; and thanks to the rapid strides taken by science and technology in recent years, know-how is available. Yet, things do not seem to be moving the way we would like them to be. This applies as much to the fields of food and health as to any other area. What is perhaps lacking is a firm commitment and will, efficient coordination and managerial skills to manipulate and eventually convert to our advantage an otherwise unfavourable climate.

Food and nutrition - the most basic requisites for positive health - are closely dependent upon, and bear a strong, reciprocal, cause-effect relationship with, agriculture. It was in realisation of this fact that the two Workshops-one on 'Strategies in Agriculture Sector for Nutritional Goals', and another on 'Nutrition Education – Communication Materials, Media and Agencies', were recently held in Hyderabad under the joint auspices of ICAR, UNICEF and NIN.

Leading nutritionists, agricultural scientists, personnel involved in programmes of Higher Education in Food and Nutrition (HEFN) and experts in the art and science of communication participated in the deliberations of these Workshops. Apart from affording ample opportunities for exchange of academic information, the Workshops have provided an in-depth analysis of the existing situation and several useful pointers for future action.

Dr. M. Mohan Ram and Mr. V. Ramadas Murthy of this Institute have helped in editing this volume of Proceedings brought out with the support of UNICEF. It is hoped that this publication will be found informative and useful by all who are interested in the promotion of food, health and agriculture and will eventually enable us to move closer to the goal of achieving better quality of life.

National Institute of Nutrition
Hyderabad - 500 007, India
December 1980

P. G. TULPULE
Director

Workshop on

'Strategies in Agriculture Sector for Nutritional Goals'

(July 21-22, 1980)

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Monday, July 21, 1980

INAUGURAL SESSION

10.00 a. m.	Welcome	:	**Dr. P. G. Tulpule** Director National Institute of Nutrition Hyderabad
			Dr. V. Nagarajan Asst. Director-General Indian Council of Agricultural Research, New Delhi
			Mr. J. F. Coloane Asst. Programme Officer UNICEF, New Delhi
			Dr. (Mrs) P. Pushpamma Dean College of Home Science Andhra Pradesh Agricultural University Hyderabad
	Inaugural Address	:	**Prof. V. Ramalingaswami** Director-General, Indian Council of Medical Research, New Delhi
	Presidential Address	:	**Dr. J. Raghotham Reddy** Vice-Chancellor Andhra Pradesh Agricultural University Hyderabad
	Vote of Thanks	:	**Dr. M. Mohan Ram** Asst. Director National Institute of Nutrition, Hyderabad

Monday, July 21, 1980

SESSION - I

Chairman : **Dr. V. Nagarajan**
Asst. Director-General
Indian Council of Agricultural Research
New Delhi

Rapporteur : **Mr. V. Ramadas Murthy**
Asst. Research Officer
National Institute of Nutrition, Hyderabad

11.15 a. m. Production technology and programmes and cropping patterns in irrigated/rainfed areas : **Mr. A. Venkataraman**
Vice-Chancellor
Tamil Nadu Agricultural University
Coimbatore

12.00 noon Nutrition dimension of high yielding and hybrid crop varieties : Locational and varietal differences in nutritive value : **Dr. Y. G. Deosthale**
Senior Research Officer
National Institute of Nutrition
Hyderabad

SESSION - II

Chairman : **Mr. A. Venkataraman**
Vice-Chancellor
Tamil Nadu Agricultural University
Coimbatore

Rapporteur : **Dr. Y. G. Deosthale**
Senior Research Officer
National Institute of Nutrition, Hyderabad

2.00 p. m. Strategies for increased production of cereals and millets : **Dr. M. V. Rao**
Project Director
All India Coordinated Wheat Improvement Project, IARI, New Delhi

2.45 p. m. Strategies for increased production of pulses : **Dr. Y. L. Nene**
Leader, Pulses Improvement Program
ICRISAT, Hyderabad

3.45 p. m. Strategies for increased production of oilseeds : **Dr. A. C. Chhatrapati**
The Vanaspati Manufacturers' Association of India, Bombay

Tuesday, July 22, 1980

SESSION - III

	Chairman	:	**Dr. P. G. Tulpule** Director National Institute of Nutrition, Hyderabad
	Rapporteur	:	**Dr. V. Jagadeesan** Research Officer National Institute of Nutrition, Hyderabad
9.30 a. m.	Nutrition Oriented Agricultural Production	:	**Dr. H. K. Jain** Director Indian Agricultural Research Institute New Delhi
10.15 a. m.	Consumer acceptance qualities of new varieties of food-grains	:	**Dr. (Mrs) P. Geervani** Prof. & Head (Foods & Nutrition) College of Home Science Andhra Pradesh Agricultural University Hyderabad
11.15 a. m.	Strategies in Poultry and Piggery Development	:	**Dr. C. Krishna Rao** Former Vice-Chancellor Andhra Pradesh Agricultural University Hyderabad
12.00 noon	Strategies in Horti-culture/Nutrition Gardens	:	**Dr. S. N. Rao** Senior Scientist, Fruit Research Station Sangareddy, A. P.

Tuesday, July 22, 1980

SESSION - IV

	Chairman	:	**Dr. A. Appa Rao** Director of Research Andhra Pradesh Agricultural University Hyderabad
	Rapporteur	:	**Dr. Ramesh V. Bhat** Senior Research Officer National Institute of Nutrition, Hyderabad
2.00 p. m.	Strategies in Fisheries Development	;	**Mr S. Banerjee** Director of Fisheries, Andhra Pradesh Hyderabad
2.45 p. m.	Role of Agro-Industries, Agricultural Marketing and related activities in employment generation	:	**Dr. Waheeduddin Khan** Member (Senior Faculty) Administrative Staff College of India Hyderabad

CONCLUDING SESSION

Inaugural Session

Monday, July 21, 1980

Welcome Address

Dr. P. G. Tulpule
Director, National Institute of Nutrition, Hyderabad.

Prof. Ramalingaswami, Dr. Raghotham Reddy,
Participants of the Workshop, Dr. Nagarajan, Mr. Coloane,
Dr. Pushpamma, Ladies and Gentlemen,

It is my pleasure to extend a hearty welcome to you all, on my behalf and on behalf of the staff of the Institute to this inaugural function of the Workshop on "Strategies in Agricultural Sector for Nutritional Goals".

We feel deeply grateful to Dr. J. Raghotham Reddy, Vice-Chancellor of the Andhra Pradesh Agricultural University for accepting our invitation to preside over the function. His presence amongst us is certainly a source of encouragement. The Andhra Pradesh Agricultural University has always extended all facilities for providing genuine seed material for nutritional studies carried out at this Institute.

My foremost duty at this moment is to extend a warm welcome to Prof. V. Ramalingaswami, Director–General, Indian Council of Medical Research, for his kindness in accepting our invitation to be the chief guest today and to inaugurate the Workshop on "Agricultural Strategies". The importance which the Indian Council of Medical Research attaches to collaborative efforts and training activities of the Institute is evident from his presence here today.

This Institute has had many years of useful collaboration with the ICAR and UNICEF. We have now once again come together as organisers of two very useful Workshops, one on "Strategies in Agriculture Sector for Nutritional Goals to be held today and tomorrow and the Workshop on "Nutrition Education–Communication Materials, Media and Agencies" to be held on the 23rd and 24th of this month at the Home Science College.

We, at the National Institute of Nutrition, are particularly thankful to Dr. O. P. Gautam, Director-General, Indian Council of Agricultural Research and Mr. Glan Davies and Dr. J. P. Greaves of UNICEF for kindly agreeing to hold the Workshop on "Agricultural Strategies" at our Institute. We are

happy that Dr. V. Nagarajan is representing the Indian Council of Agricultural Research and Dr. J. F. Coloane is representing UNICEF at this function. It is also a matter of satisfaction to us that the ICAR and UNICEF have given us the opportunity to revive the training programme in human nutrition for teachers in Agricultural Universities. The Course which has started from 1st June, 1980 has eight participants drawn from different States of the country. The two Workshops now being organised are a part of this programme.

Training in human nutrition has been an important activity of the Institute and our participants have come from different parts of the country and from different countries in the developing regions. Over the years, we have built up a strong team of expertise in various disciplines allied to nutrition. Our scientific staff comprising biochemists, biophysicists, clinicians, social scientists, public health nutritionists and statisticians form the core faculty for the several training programmes which this Institute offers. Also, as many of you are aware, the Institute has all the requisite support facilities like the library, sophisticated instruments for advanced work, experimental animal facilities, well equipped class rooms and laboratories, easily accessible bed-side clinics and typical Indian field conditions. All these together form a fountainhead for nutrition knowledge which we have been happily sharing with many scientists and teachers.

It is at this juncture that I acknowledge with thanks the enlightened and excellent support, both financial and otherwise, given to our various training programmes by the UNICEF. With this support, we have been able to strengthen our training potential, equipping ourselves with the necessary physical facilities so essential for the training and research activities. The ICMR, our parent body has always offered encouragement in the conduct of these various training courses at our Institute.

I also acknowledge the invaluable collaboration we have been forging with the ICAR in the Institute's research as well as training activities. With the support of the ICAR and the different Coordinated Improvement Projects for various foodgrains, we have been able to pursue researches on the new high yielding and hybrid varieties and ensure their optimal nutritive values.

The field of food toxins has received special attention in the Institute's research programme. This is evidenced by the fact that a separate centre for study of Food Toxicology has been established by the ICMR at this Institute.

The link between agriculture and nutrition has been further strengthened with effective coordination between ICAR and ICMR. A joint Panel

constituted by the two Councils reviews problems of common interest, particularly post harvest technology and health hazards. I am sure that an integrated approach of this nature would certainly help in promoting awareness of the need for an appropriate agriculture and food production policy to meet the nutritional needs of the population.

I must mention here that the basic groundwork and planning for holding the Workshops were done several months earlier when Dr. S. G. Srikantia was holding the Directorship of this Institute. It is a matter for gratification that Dr. Srikantia is now amongst us and has agreed to participate in the Workshops. He will be chairing a session in the Workshop on Nutrition Education.

The idea of holding these two Workshops has been to focus attention on the fact that improvement of the nutrition status of our people hinges on two important aspects. Firstly, vigorous and multipronged strategies have to be applied to augment the food resources in an effort at providing adequate food to the growing population. Secondly, and almost simultaneously, efforts must be made to disseminate nutrition information through purposeful nutrition education of the community on scientific lines.

With these introductory remarks, I once again extend a warm welcome to all the invitees and participants of the Workshop. I am sure that we will have fruitful discussions during these two days of deliberations. Now, I request Dr. Raghotham Reddy to preside over the meeting and conduct the proceedings.

Extracts from the Welcome Speeches by Representatives of ICAR, UNICEF and the Andhra Pradesh Agricultural University (APAU)

Dr. V. Nagarajan, Assistant Director-General (Nutrition), ICAR, spoke of collaboration of the ICAR and ICMR in the nutritional improvement and evaluation of sorghum, groundnuts and algae and the major role of agricultural technology vis-a-vis nutritive value of foods.

Mr. J. F. Coloane, Assistant Programme Officer, UNICEF, stressed that well-being of the mother and child, and specially nutrition of the young child has been a major concern of UNICEF. He said that the quality of life of children needed much improvement and stressed for better integration of nutrition and agriculture.

Welcoming the gathering on behalf of Andhra Pradesh Agricultural University (APAU), and the College of Home Science, Dr. P. Pushpamma said it was time that we paid attention not only to the quantitative but also qualitative aspects of food and pleaded for the case of strengthening and supporting the discipline of Nutrition in Agricultural Universities.

Inaugural Address

Prof. V. Ramalingaswami

Director General,
Indian Council of Medical Research, New Delhi

Dr. Tulpule, Dr. Nagarajan, Madam Pushpamma, Mr. Coloane, Dr. Srikantia, Ladies and Gentlemen,

I am very delighted to be associated with this activity, because I believe that although many of us here are engaged in research - biomedical, biological, or applied or field oriented research, the topic of today as well as the succeeding Workshop topic - education, are really at the root of any success that we may hope to achieve. H. G. Wells once said that the choice before mankind is between education and catastrophy. I very sincerely believe in this; and in this process of education, the educators are certainly quite important, although we often tend to forget the viewpoint of the educated. I would like to summarise what I have to say because I too do not want to stand between you and the Presidential Address.

In all developmental efforts, man is at the centre and I want to clarify immediately that I include women too. Man and not just the growth of things, although I do not underestimate the importance of the growth of things, the underprivileged man, the disadvantaged man, the marginal man as it is used in the agricultural terminology, is the prime focus. The young and the poor are the ones who suffer most from underdevelopment, from malnutrition. The fruits of any developmental effort should improve their condition, their quality of life as a matter of priority and I think this is said on many platforms.

The pursuit of economic goals has been the sheet anchor of our national planning effort, indeed of all planning efforts anywhere and this is absolutely right because economic growth is essential for overall devolopment. The developmental history of developed societies teaches this lesson to us, although it also teaches us many other lessons. Essential, as it is, for development, the concept of economic pursuit relentlessly without concern for equity, for distributive justice has often led to an accentuation of already existing social and economic disparities in societies, the poor becoming poorer and the rich be-

coming richer. We know this story; the social services devleopmental inputs provided by the State being syphoned off by the relatively few in the more advanced sections of the society. This is now a familiar theme in all developmental forums and several countries, including our own, are making very serious efforts to try and change the priorities, to correct the distortions that have crept in and bring the focus back on to human development as the prime goal of development.

The theme of the Workshop, I believe, is symbolic of this movement, with special reference to interaction between food and agriculture policies on the one hand and nutritional realities on the other. This issue, as Dr. Pushpamma has said, has assumed a certain amount of acuteness because we find ourselves in the position of having relatively large surpluses of foodgrains and yet we are confronted with the most severe and the most intense forms of malnutrition that there ever are on this planet, just in this country. Here, the main question of course is that the people, the poorer sections of society do not have the purchasing power to obtain the food to fulfil their so-called minimum needs. Dr. Nagarajan and Dr. Swaminathan, sometime back, told us that the per capita availability of foodgrains in this country has been improving steadily. But these national per capitas and national averages, hide a deep human tragedy. Because an average is an average after all and it has a spread both ways beyond this line of average. Substantial sections of the population are unable to fulfil their minimum needs, although the national averages may look quite respectable. So, this mis-match, as Dr. Swaminathan calls, between our ability to grow sufficient food and our ability or the ability of our people to buy the food for sustenance purposes is the real dilemma of our present generation. The unemployed, the under employed and those that are even fully employed but are earning so very little, these are the ones who need to be engaged in productive work to bring about substantial increase in their earnings. What is required then is a strategy of rural development which will increase employment abilities and earning abilities of the poorer sections of the society and several speakers in this Institute have drawn attention to a large number of programmes that have now been launched by the Government in the form of Food for Work programme, employment guarantee and so many other projects. All these are supposed to build what are generally known as durable assets in the countryside, at the same increasing the income.

The title of the Workshop speaks about two things, one is agricultural strategies and the other is nutritional goals. Perhaps it is better to look at a strategy in terms of the goal and be very clear first about the goal. What are

Prof. V. Ramalingaswami, Director-General, Indian Council of Medical Research, New Delhi, delivering the Inaugural Address, at the Workshop on "Strategies in Agriculture for Nutritional Goals". Also seen on the dais are (from left to right) ; Mr. J. F. Coloane, Dr. P. G. Tulpule, Dr. J. Raghotham Reddy, Dr. M. Mohan Ram, Dr. V. Nagarajan and Dr. Mrs. P. Pushpamma.

our national nutrition goals? The ultimate goal is the provision of food in sufficient quantity and of an appropriate quality to all the members of society, each according to his or her own physiological needs. This means of course, we look into the specific needs of infants and children, they have their own needs, the specific needs of expectant and lactating women and the specific needs of those that are engaged in different levels of physiological activity involving different requirements of energy. But this is the ultimate goal. There are intermediate and more immediate goals. Immediate goals in order to do something about the vast spectre of malnutrition we see all over and we cannot remain passive spectators saying "we are aiming at the final goal of providing enough food for everybody, everything will be well in the millenium." Well, we cannot do that, we are humans, and even hard-core economists have now begun to realise this human dimension. So, we have to do something. Collosal as this problem is, with the current level and tempo of development, how is one to go about it? Anything we talk of in India is in terms of millions, astronomical figures, nothing is short of that.

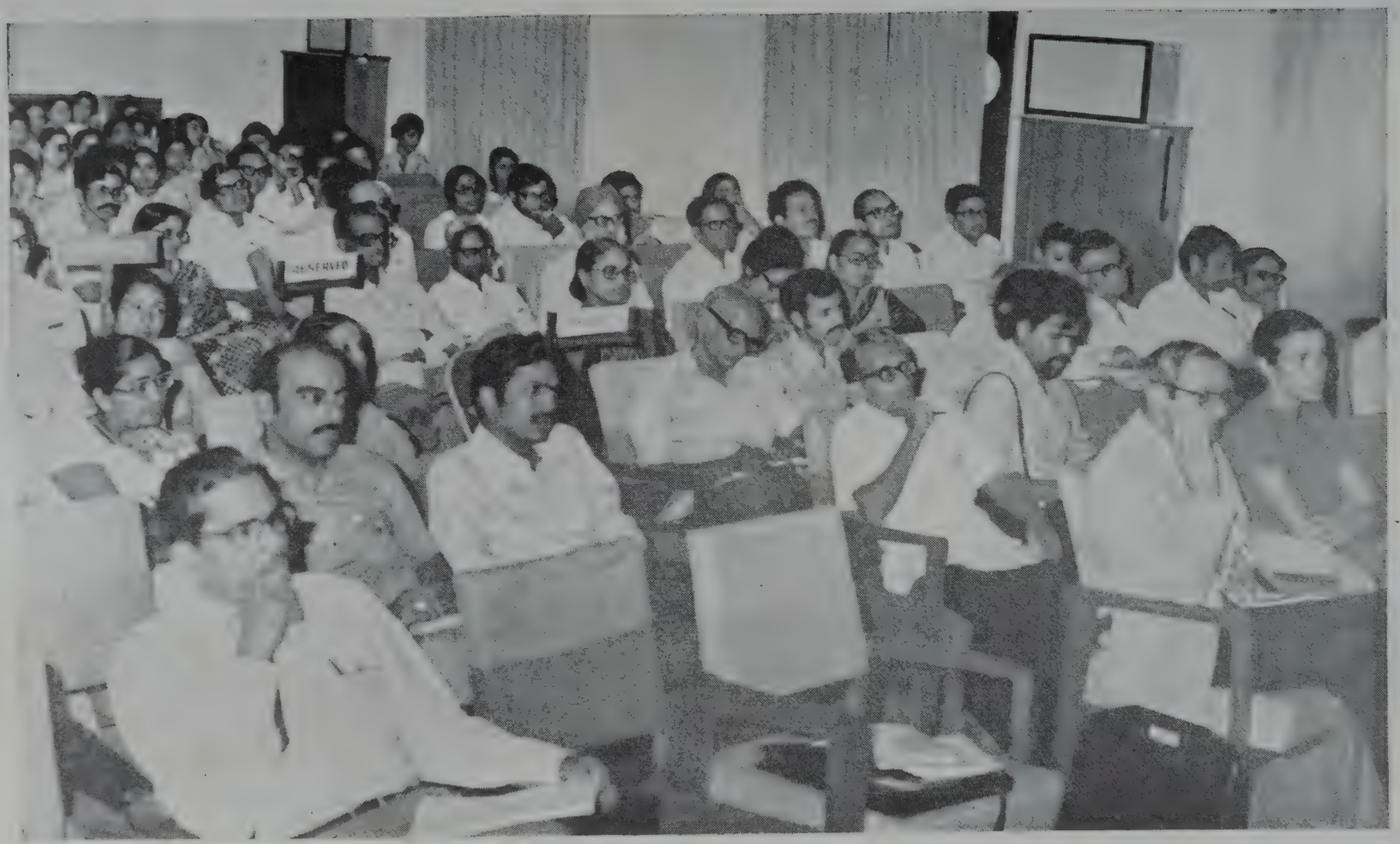
So I do not want to get into this rather attractive side-lane of presenting figures, how much malnutrition there is and how terrible the whole situation is. It is suffice for us to take note of the fact that we are indeed surrounded by a very, very major problem. And what is important and what I want to really emphasise is that for tackling this we have the knowledge and the technology; effective technologies are available. But the difficulty is how to apply them, how to bridge that gap between the most distal point in our service apparatus and the places where the people live. This, I think, is the dilemma of all science and technology today when it is the question of applying it to developing societies. The knowledge action interphase is the real essential problem and what are those steps that we need to recognise, promote and cultivate in order to get this knowledge back into action.

Take for instance the problem of protein energy malnutrition. The low purchasing power of the families is immediately linked, the large number of children in the family is linked, how many female children in the family is again linked, with it. Tradition, taboos, attitudes, perceptions of the mother about infant rearing practices, and how one divides the small amount of food that comes into the family between the members of the family; what are the priority ranking of the different members of the family? Is it recognised that the expectant mother or the young, growing child is the top priority in the family? But at the same time how can you cut out the calories to the man who is actually providing the meagre amount ? These are the dilemmas and the real crux of the problem of malnutrition. And there are many others that one

can illustrate in respect to a given situation in producing and perpetuating malnutrition and protein energy malnutrition is certainly the *prima donna*, the main example of this.

So the intervention strategies that we develop on the basis of our technology have to take note of all this matrix of factors, the inter-play of these factors and must go far beyond supplementary feeding. We spent most of our meagre resources, those coming from outside as well as our indigenous resources on supplementary feeding which is necessary. I am sure many people have benefitted in this kind of operation. But what is the goal? Prof. Sukhatme, one of our finest Statisticians in this country, estimated we might have been spending a 100 crores of rupees in supplementary feeding. no matter from where the money is coming; this is the order of investment we have made and I am sure we have done some good to some children and some others. But strictly speaking really what is the ultimate goal of this? Have we basically changed the attitudes of the mother in feeding? Have we built up insights into the whole process of child growth and development? These are the questions which we need to ask ourselves. It is not just feeding these people although I fully recognise that feeding is very important.

Now I want to go back from the nutritional goals to the agricultural strategies and look at the scene. Viewed in this angle, we can see the ramifications of agricultural strategy as really very very extensive. Not just one or two strategies, a number of substrategies. Firstly we recognise that increased food production is essential for improving nutrition. I think we must also recognise that China has been able to get over the problem of endemic forms of malnutrition not so much through spectacular increase in agricultural production, although that has happened. But I think most people will agree that although increased production must have played a part, the real thing that they did is distribution, the ability to reach the people with the food that they have produced in the country. We are not able to reach the people. This is our problem. The pattern of our food production must be influenced by considerations of not only national economy but of the human dimension of food production. That is all that we are saying and I think this message has already been very forcefully conveyed by those who have welcomed us here this morning. Well in that kind of pattern of food production, what is the pattern we look to, what is the place of increasing pulse production, or oilseed production, or animal protein production ? All these and quantitation of these, over a time frame, in relation to the knowledge that we have about human requirements for these, is essential and that I guess is one of the major exercises that is involved in today's topic discussion.



A view of the audience at the Inaugural Session of the Workshop on Agricultural Strategies

We also look at another dimension and that is of course that we try and minimise the losses of food that we produce. This has also been referred to and I think is also one of the dimensions of the topic for our discussion today; so called postharvest losses which have been estimated differently, but even if you take the most conservative estimate of 10 percent loss, the figure still comes to a collosal amount. It is only very natural that we must conserve maximally what we produce with so much difficulty. Here we have the problem of humid tropical climates presenting some special problems and we need to develop our technologies sufficient in order to overcome these. There are quantitative losses, there are qualitative losses, the positive health hazards that crop up in the course of storage process and distribution etc. of the food that we produce. But then one has to move further beyond. Increasing the purchasing power of the poorer sections is part and parcel of the wider strategy of rural reconstruction and rural development. But this is very central to the problem of food-nutrition nexus in India today. This food–nutrition nexus is part of a rural development strategy taking into account the necessity for us to harmonise among other things the incentive prices for farmers with low prices for consumers. How do we do this? This is the Indian rope trick balancing act that we have to do. Through state action we need to adjust the prices of key foods to subserve the optimum nutrition, and provide the people minimum wages and there is a whole lot of strategies that are known in this regard.

There is the other well known field of nutritive value of high yielding varieties and generating nutritionally superior qualities through gene technologies, surveillance of residues of pesticides, insecticides, these are all well known and one needs to look at these dimensions also.

Even all this is not enough. In my view, the optimisation of the food-nutrition nexus has to go far beyond the domains of agriculture and health. Safe water supplies, environmental sanitation, immunisation, other methods of disease control, controlling the family size, each of these has a definite place in this food - nutrition nexus which we want to optimise for the greatest human benefit. The linkages between all these elements are very many ; they are very complex. I do not want to go into them, but I do want to say that the most powerful influences which have widespread impact on improving nutrition of the people lie outside the traditional nutrition field. This is also true of health. Sooner we realise and recognise this, establish bridges, bonds linkages, between the various agencies, between the various sectors, the better it is for health and nutrition.

As I said, increased food production and availability are essential pre-requisites, but for it to subserve human nutrition goals maximally, our activities must transcend not only the sub-disciplines within health, nutrition, food, agriculture sectors, but extend far beyond into education which I am very happy to see in the next seminar. All this is called inter-sectoral and intra-sectoral coordination and integration. These are the catch words today everywhere. These are attitudes of mind and this is a question of philosophy, what you are really aiming at. You may be working here in this Institute, you may be working somewhere else but what in fact is the ultimate purpose of our efforts. So I would say Nutrition for All is a goal. It is a part of the goal of Health for All, by the year 2000 A.D. which 134 Nations pledged to achieve in the historic Alma Ata Declaration in 1978. The most important strategy for achieving Health for All, of which Nutrition for All is a component, is primary health care. Increased food production to subserve human nutrition is an essential component of the primary health care package as it was spelt out in Alma Ata in 1978. And its success depends upon activation of the community.

Activation of the community in self help and in self care, has already been sparked off I believe in respect of agriculture. What I heard through Raghothamji was that Training and Visit system to activate the farmer. We have not been able to achieve this in health. We are dreaming, we are hoping to move to that stage of getting the community to take their health in their own hands, the nutrition in their own hands and demand the services of the State and of the society. Once a need is transformed into a demand the battle is won. Democracy has succeeded. This I think is the essence of all the efforts that we are doing. Its success depends upon the ability of all of us who are providers of services, agents of agricultural care or health care or whatever you want to say.

We must be able to work across the disciplines, we must be able to talk to each other, we must be able to go across sectors, for a common purpose. In short, development, planning, and execution depends essentially on our ability to build less walls and more bridges. That, Raghothamji, is the kind of message that I have brought and I know that I have stood between you and our friends here for far too long. I have great pleasure in inaugurating this workshop.

Presidential Address

Dr. J. Raghotham Reddy
Vice-Chancellor
Andhra Pradesh Agricultural University, Hyderabad

I am very happy to be here with you today.

If we trace the course of agriculture over the decades, almost till the 1950s or 60's, meeting the problem of hunger was the main consideration. And soon we were to go into the problem of food. It was only in the seventies that we have, atleast on a national level, cut across that dividing line, and from then on we are beginning to deal not with the problem of hunger but the problem of food. And when you go into the problem of food, most obviously nutrition becomes a very prominent component. Stratetgies of agricultural sector are not all planned at the planner's level. The decisions in regard to strategies of agricultural production lie in millions or hundreds of millions of homes all over the country. Decisions have got to be taken there and all that the educated elite or the scientifically trained elite can provide is the knowledge to the people on the basis of which these decisions could be taken.

It is true that whatever problem we start thinking about, we come across the problem of poverty as the biggest hurdle. We may have the food but some of the people at least do not have the wherewithal to buy the food we have, which we are unable even to keep under a leak proof, roof.

So the problem of economic development is central to all problems in a developing country. But apart from that, we have not even succeeded in taking the knowledge of nutrition to the farmer. It is anybody's knowledge that the people who are producing milk and marketing through the Dairy Development Corporation are not giving enough milk to their own children. People who are growing pulses are not providing all the pulses that their own children or their own family members need. This is because pulses are costlier than cereals and they sell the product in the nearest market or to the nearest trader. And why does not this knowledge reach the centres of scientific activity? It is because it is so difficult to put a scientist in a village. All

the knowledge that the sophisticated scientist gets is from the so-called 'evaluation reports'.

We have our own problems. After all, agricultural universities are too small to tackle the gigantic problems. We produce about 400 graduates in agriculture, another 120 or 140 in veterinary medicine and another 80 in home science. This is a very small and insignificant part of the university trained men in this country. If this stupendous task of carrying the message of better nutrition to the people at large is entrusted to this small group, I wonder how long it will take. Certainly, Dr. Ramalingaswami, it will not be before 2000 A. D.Not that we are reluctant to do all that we can. But our own capacity based on the size of our organisation becomes a limiting factor. I think it was Dr. Nagarajan who was talking about agriculture budget. The only remark that I can and would like to make is, that smaller the agriculture budget bigger will be the public health budget. So viewed from this angle, government does not save very much by investing less on agriculture.

But granting that government puts more money into agriculture, is it not the duty of the people who are fortunate enough to become scientists, who are part of the great erosion of talent that is taking place in the villages, to go back and stay there as a part of their regular duties ? Any person administering a university more particularly agricultural university knows–and I think my friend Dr. Venkataraman will bear me out-that it is sometimes beyond the human competence to make the scientist live in the villages. They give so many excuses. And one has to be harsh. Or sometimes cease to be harsh and succumb to the pressure that builds against sending scientists to villages.

So my question is apart from what Dr. Ramalingaswami told us and apart from so much that all of know, how do we carry the knowledge to the villages ? Agricultural universities are very poor too, very small too, very inadequate too. What is the whole agricultural education system in this country doing about it ? Talking about my own state, there are about 20,000 villages. Almost every village has a school and every school has a teacher on the pay roll whether he stays in the village or not. And small school text books are written to pupils in primary classes. After all, what we are trying to do is to make them literate. In order to make them literate you will have also to impart knowledge. Is that knowledge an essential requirement for their well–being ? We can always talk about many things. We can always talk about geography or history such as when Ashoka ruled or Alexander invaded and so on. But how many of our small elementary text books of primary schools contain lessons on nutrition ? How many of our school teachers have been trained in nutrition ?

These are some of the basic problems that confront this country. True, our economic development must go up. It is true that we must have more purchasing power. It is also true that agricultural production of vital foods must go up. But then is the market willing to offer a relatively higher price for pulses than cereals ? Pulses even today, to the extent which I understand, are not responsive to high fertilizers or irrigation. On a per acre basis they still take a monopoly of dry land and have not gone into the irrigated areas yet to the sufficient extent. Take our oil seeds. Does edible oil seed safflower which is talked of highly in terms of its health-giving qualities, does it respond to fertilizer, does it respond to irrigation ? Has it made inroads into the irrigated areas in our river valley projects? It has not. That is of course the problem for plant breeder in the field of agricultural science. Dr. Swindale has a huge institution where he is trying to grow these under semi-arid conditions. Somebody else would have to try to grow these under irrigated conditions too. For example, in the Nagarjuna Sagar area, you find the farmer growing sugar-cane, or rice, or he rarely grows groundnut, that too mostly unwillingly. These are the spectacles that stare you in the face.

So gentlemen, we have got to think of market economy. We have got to see if we can so manage the market that these essential foods like pulses, and oilseeds etc get as high a price on the man-hour basis as the irrigated crops like rice or any other cereals. Even millets are going out of fashion. In the areas where millets were being consumed they are no longer being consumed. As man climbs up the economic ladder he thinks that it is beneath his dignity to consume millets. Millets are considered to small for the big man, and too unusual for the small man. Nobody takes them.

So far as the Training and Visit system is concerned, I am not still aware whether nutrition education is part of the Training and Visit system. They still want you to grow crops irrespective of the price that the market offers. I do not know if 4,000 sub-assistants in the department of agriculture, in Andhra Pradesh have ever been initiated into the elements of nutrition. I do not know whether in their in-service training, agricultural graduates now with the department of agriculture have had a chance of hearing a good lecture on nutrition. Or whether they have been given literature on nutrition. Because given the literature, we hope they will read. We have succeeded this year of putting 240 boys from our final year classes into the villages. For one semester they are living with the farmers. Our Agricultural Extension Specialists are looking after each group in the 4 or 5 villages. No village has more than two. We have attached each to one farm. We are trying to put across nutrition information through them. But how many villages do we

reach out of 20,000 in Andhra Pradesh. In a whole year probably we may reach very inadequately about 120 villages. But 2,000 A. D. is too short a period for the agricultural universities to reach the target unless you can rope in bigger institutions.

Each one of us here has been educated at the cost of the country. The country is yet far poorer than us. How many of us have looked back and said that we owe a debt of gratitude to those that are poor, that are suffering from privation but have found enough energy to make money and pay in the form of taxes for the education of all of us ?

I reiterate what the distinguished speakers said earlier that the emphasis is shifting from gross national product purely in terms of money value of the services and products generated, to the total welfare of the country's people. What is very important is that knowledge gap between those that are expected to practice better nutritional standards and the people competent to impart this knowledge should be bridged. More of us should be going to villages and more of us should be talking to villagers. More of our undergraduates when they go home on vacations at least must be talking to them. This, ladies and gentlemen, is the need of the hour.

SESSION - I

Monday, July 21, 1980

Chairman : **Dr. V. Nagarajan**
Assistant Director-General
Indian Council of Agricultural Research, New Delhi.

Rapporteur : **Mr. V. Ramadas Murthy**
Assistant Research Officer
National Institute of Nutrition, Hyderabad.

Production Technology and Programmes and Cropping Patterns in Irrigated / Rainfed Areas

Dr. A. Venkataraman
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Food position in India is fairly comfortable in the current year. Despite two consecutive droughts and distribution bottlenecks, we have been able to manage without imports and hold on to a reasonable reserve. Farmers, agricultural scientists and development staff can take legitimate pride for these achievements.

But we cannot rest on our laurels. Another year of drought could be catastrophic. Some are in fact, of the view that the apparent surplus position is partly due to the low purchasing power of the people. The food problem is likely to be further magnified since the family planning programme has not had the desired impact on population growth. We are faced with the prospect of feeding about a billion mouths when the new century dawns. Calorie and protein gaps are expanding. Production of pulses and oilseeds in the country has not been altogether satisfactory and we had to resort to huge imports to stave off scarcity and to keep prices within reasonable limits. The current worldwide energy crisis is likely to jeopardise our production targets. Today, we find islands of progress and prosperity. This situation is clearly due to improper distribution of the benefits of technology. The gap between progressive farmers and marginal farmers and between what is potentially possible and actually achieved must be narrowed.

To meet all these challenges, agricultural production has to be increased two to three three fold and the time available is very short. Hence our strategy should be to increase the production per unit area of land per unit time with the available resources, upgrade production technology on a war footing and reduce the gap between research and adoption.

Availability of land for cultivation is limited and there is no possibility of extending the cultivable area to any great extent. Hence the available land should be more *intensively* cultivated. One way of doing this is by increasing

the extent of irrigated lands. At present, over 80 per cent of all the cultivable area in India is rainfed. There are possibilities of further exploiting the surface and underground water in the Indo-Gangetic plains and Norrth Eastern region. In Tamil Nadu, almost all the available irrigation resources have been fully exploited and already the groundwater table is going down at an alarming rate in some areas due to over exploitation. Where potential for further exploitation of irrigation resources does not exist, irrigated area can be increased to some extent by better water resource planning and management. We have made a small beginning in Tamil Nadu in this direction by taking the major ayacut areas for better water management and use. We hope to save considerable amount of water by efficient water management and use the saved water for irrigating some more area and for recharging the ground water.

It is well known that when major irrigation resources are developed, farmers invariably switch over to water loving crops like rice and sugarcane due to rising water table and difficulty in drainage. This ultimately leads to movement of salts from deeper layers of soil to the surface resulting in salinisation. We have the examples of Punjab and Haryana and now the Tungabhadra region, where the area of salt affected soils has increased enormously after the introduction of large scale irrigation. This may repeat itself in other areas also where new irrigation projects are undertaken, unless sufficient precautions are taken to reduce overuse of water, impeded drainage and rise in water table. If proper use of water planning and management are not taken up on an urgent basis, once potential lands will become waste lands. More research is called for extension efforts in this direction.

Here we must take note of one thing. Once the water supply is assured, intensive crop production is an attractive proposition. Introduction of high yielding, short duration and photo-and thermo-insensitive varieties has been a desirable development. It has become possible to raice three or four crops in a year where only two crops were raised previously. Relay cropping and intercropping have helped to increase the cropping intensity. By suitably adjusting the geometry of planting (like paired row system), one more crop can be accommodated without reducing the population of the base crop or adversely affecting its yield. The choice of crops should be such that they are complimentary, and not competitive to each other. Several studies have been conducted in the country to choose mutually beneficial crop combinations for the given soil and agro-climatic conditions and the results are quite encouraging. By including a legume as one of the crops, it is possible to save a part of the fertilizer nitrogen applied to the crop mixture. Similarly,

by relay planting, considerable amount of expenditure on field preparation can be saved and the time lag between two successive crops reduced. Here again, by proper choice of crops, it is possible to reduce the fertilizer application to the system.

Though work on these lines has been going on in the country for more than a decade, concerted attempts have not been made to develop management practices for the cropping system as a whole. Information on such efforts has been sporadic and scanty. Work done at Tamil Nadu Agricultural University has indicated that in a cropping system involving cotton-sorghum–ragi, about four tonnes of crop residues are added annually per ha. and there is a possibility of saving about 25 percent of fertilizer NPK recommended to the crops involved in the system. Similar work should be intensified and integrated water, pest and soil fertility management practices have to be developed for cropping systems.

Freedom of choice :

Choice of crops and cropping systems is generally based on productivity and profitability. But the long range perspective of maintaining soil fertility and productivity and minimal disturbance to the ecosystem should be kept in mind. Without proper residue and soil fertility management, 'soil mining' might occur resulting in reduced production. Serious attention must be given to this aspect.

Scientists should develop viable cropping systems with proper management practices and also should offer alternatives to the farmers, adopting the crop cafeteria approach, leaving the ultimate choice to the farmers. At the same time, adequate infrastructure should be developed to provide the inputs, credit and marketing facilities to the farmers at the proper time. Unless this goes hand in hand with the extension of research results to the farmers, scientific research will not have the anticipated impact on production.

A significant breakthrough in yield potential of wheat and rice was achieved in the 1960s through concerted research on developing efficient plant ideotypes. This led to the much acclaimed green revolution. Today almost all the cultivated varieties of wheat and rice in India have the improved plant type in their blood and remarkable increase in the production of these two crops has been achieved.

But the yield levels of pulses and oil seeds have been static for the past three decades. The need for a similar breakthrough in yield potential of pulses and oilseeds as in the case of cereals has been universally recognised

and steps have been taken to intensify research on these lines. Until the results of such efforts are available, we have to make an all out drive to increase the production of these crops by extending the area of cultivation, wherever possible, and by large scale adoption of improved agronomic techniques. As stated earlier, extension of cultivable area has very limited scope. But in the case of pulses, it is possible to fit them in intercropping and multiple cropping systems because of their non-competitive nature and nitrogen fixing capacity. Raising pulses as companion crops has considerable scope both in irrigated and rainfed areas and this will raise the total production of pulses in the country considerably.

Introduction of newer crops :

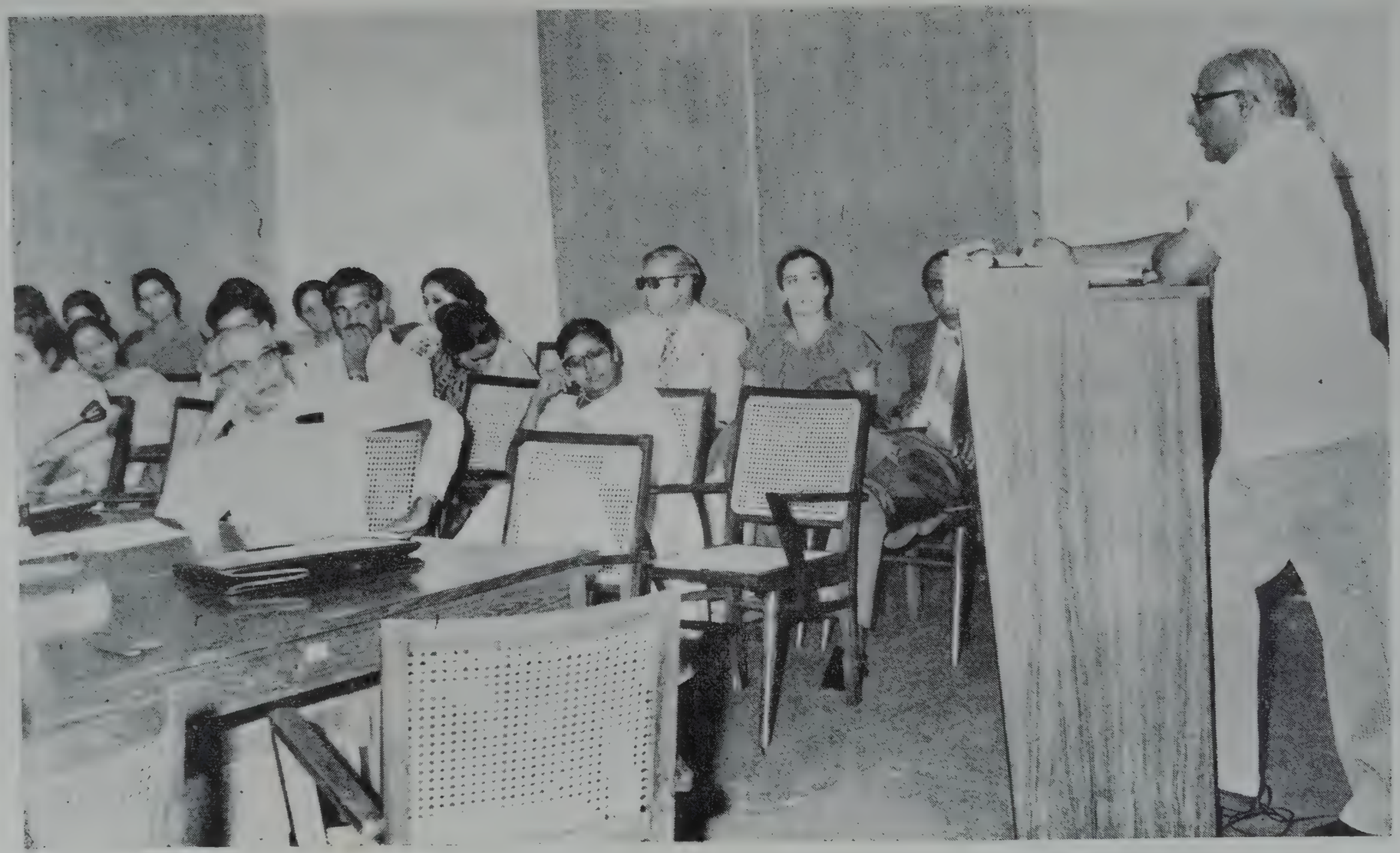
Another area worth pursuing is introduction of promising new crops. No doubt, soyabean and sunflower have not been very widely taken up by farmers because of consumer resistance and instability of yield. But the crops offer considerable promise for the future and work is in progress to remove the bottlenecks in production and marketing. Crops like winged beans, bambara groundnut and sword beans could be studied for their suitability to our conditions and they may hold the potential for achieving the breakthrough we want in pulses and oil seeds. Controlled use of water is essential. There has been little progress in technology relating to command area development and tank management.

Most of our research efforts have been directed towards irrigated crops in the past. There has been a realisation now, however late, that unless the dry lands are made more productive and until dry land agriculture ceases to be a gamble with nature, the overall economic situation of the country in general, and of the farming community in particular, will not improve substantially.

World's desert area appears to be enlarging and droughts periodically occur causing economic devastation of whole nations. Ground water table is falling rapidly and salinisation of agricultural lands is increasing. Nevertheless, arid lands have underexploited potential. This potential can be best exploited with concepts and methods specifically suited to dry regions.

Dryland farming :

Most of the practices adopted by the traditional dryland farmer have come from the experiences of his forefathers. These practices have been developed for a specific situation, tested over a long period and have helped the



Mr. A. Venkataraman, Vice-Chancellor, Tamil Nadu Agricultural University, Coimbatore, presenting a paper in the I Session of the Workshop on Agricultural Strategies.

farmer to reduce the risk involved in his occupation. These time-old practices have not been studied in detail by the scientists. It is essential that information on farmers' practices in drylands is systematically collected, analysed for their usefulness and refined, if possible, to suit the present day situation. The farmer is not likely to accept any technology, however modern and sophisticated it be, unless he is convinced that the new technology is positively superior to his age-old practices, not only in terms of productivity and profitability, but also in terms of risk reduction.

Rain water harvesting and run-off agriculture have been followed for centuries in many arid regions of the world - particularly in the middle east. These experiences could be profitably utilised in our arid and semi-arid lands. Water is the most limiting constraint in dryland agriculture and any technique to collect excess water, store it and recycle it for crop production is most welcome. The International Crops Research Institute for Semi-arid Tropics (ICRISAT), Hyderabad, has developed the broad bed and furrow system for efficient use of rain water through increased percolation, collection of run-off water and later use of it for supplemental irrigation. This technique has worked well in certain areas but not so well in others. This could be further studied and refined. Similar techniques should be developed to suit local conditions for increased water use efficiency in drylands.

Studying the existing patterns :

Whenever attempts are made to improve the productivity of a particular dry region, the tendency of the scientists is to recommend for a change in cropping pattern. Sufficient thought is not generally given to why the farmers are following a given cropping pattern in that area. The reasons may be even sociological. Unless the reasons behind the existing cropping pattern are clearly understood, any attempt to impose a new cropping pattern will not succeed. To cite an example, farmers in some parts of central Tamil Nadu raise a long duration sorghum maturing in about six months in the south west and north east monsoon seasons. This particular long duration sorghum variety is able to withstand the prolonged drought that invariably occurs in the region in the later part of southwest monsoon season and puts forth fresh growth with the onset of northeast monsoon season. Even if the northeast monsoon is subnormal the farmer is assured of harvesting at least some fodder. Attempts to introduce a double cropping sequence involving a short-duration sorghum in the place of the long duration sorghum have failed since the farmer is not sure of even a single crop if he adopts the double cropping sequence.

But the picture is not always that dismal. In the southern districts of Tamil Nadu, bajra has been the traditional dryland crop. But the crop was beset with so many problems that the yields were declining. New short duration sorghum varieties were introduced and they have become very popular with the farmers. Now sorghum has almost replaced bajra. Hence before a new cropping pattern is suggested to replace the existing one, it is imperative to analyse the reasons for the existence of a particular cropping pattern in that area. There is a vast potential to increase the intensity of cropping in drylands through double cropping, inter-cropping and relay cropping, efficient water management practices like water harvesting and proper land shaping. Not only any new cropping pattern but any innovations or tools suggested have to be field-tested.

Tree farming is another area which holds promise in drylands. Several species of trees such as Leueaena, Acacia and Brosimum have been identified which establish well with limited water supply and yield some economic produce to the farmer. Tree farming reduces the risk of dryland agriculture and its large scale adoption should be encouraged.

Systematic analysis of the available rainfall data collected over the past several years should be taken up on regional basis and the possibility of fitting a specific cropping pattern to suit the rainfall distribution pattern should be worked out. The viability of the suggested cropping pattern should be test-verified and demonstrated to the farmers through operational research projects in the region. In such operational research projects, the latest dryland technology may also be included.

In summary, the answer to the challenge of meeting the ever-increasing calorie and protein gap lies in efficient water use planning and management, increasing intensity of cropping, developing integrated water, pest and soil fertility management practices for cropping systems, building up a superior plant ideotype for pulses and oilseeds and concerted efforts to boost production in drylands. Any technology developed for dryland agriculture should not only aim at increasing productivity and profitability but also reduce risk. The present practices and cropping pattern adopted by the dryland farmer should be carefully analysed before new practices and cropping patterns are suggested. The new technology should be test-verified and demonstrated through operational research projects,

Discussion

The following salient points emerged during the discussion :

1. While bringing newer areas under irrigation, we must be cautious about the possible adverse effects on human health. Eg. 1) Increased incidence of schistosomiasis due to vector proliferation in the Nile Valley, Egypt, on extensive irrigation b) alterations in ground water table, causing imbalance of trace elements in soil.

2. Any changes in agricultural management practices may bring in other unintended alterations in the eco-system. Eg : Use of pesticides and effect on cattle and humans.

3. Emphasis must be placed on short term, quick and energy yielding plants with minimum inputs.

4. Nutrition element should be added at the agricultural planning level and nutritionists must be involved in operational research projects.

5. Use of organic manure must be encourged.

Nutrition Dimension of High Yielding and Hybrid Crop Varieties : Locational and Varietal Differences in Nutritive Value

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Among the many serious problems faced by the developing countries, nutritional problems are perhaps the most important. Those which affect large segments of the population are protein-calorie malnutrition, vitamin A deficiency blindness, iron deficiency anaemias and varying degrees of vitamin B-complex deficiencies. Numerous possibilities have been explored as means to solve these problems. Inspite of their effectiveness, most of these solutions are too sophisticated and fail to take into account the economic realities obtaining in the developing nations. Populations in these regions depend, by necessity, on diets based mostly on foods of plant origin, namely, cereals, millets and pulses. Major proportion of calories and major nutrients like proteins, as well as micro nutrients such as vitamins and m nerals in the diets are supplied by these plant foods.

Nutritional improvement of plant foods :

The role of plant foods is further emphasised by the limited possibilities of increasing the production of foods of animal origin in the near future. In view of this increasing dependance on plant foods, the logical approach to combat nutritional problems mentioned above would be through the application of modern technology to improve the availability and nutritional quality of these foods themselves.

This approach has an additional advantage. It is well known that dietary habits are most difficult to change. This is even more true when such habits are not only a time honoured practice of a population but by necessity, a compulsion within a given economic framework to appease hunger. Any improvement both qualitative and quantitative, in plant foods, therefore, would benefit the whole population with minimal intervention in their dietary habits.

It is indeed important to have more food which should be made available to all segments of the population. This aspect is being tackled quite effectively by the agricultural seientists through various programmes of high yielding varieties of food crops and better management practices for resistance to pest and diseases. In these programmes, while the criterion of agronomic performance is no doubt of prime value in enhancing the grain production, the importance of the nutritive value of these foods should receive no less attention.

The National Institute of Nutrition, Hyderabad, has been inolved in studies on nutritional evaluation of different varieties of foodgrains. The prime objective of these investigations is to examine the nutritive value of different foodgrains that have been evolved for their high grain yield potential. The studies provide information for use as an additional criterion for selection of the varieties for commercial cultivation. Second objective is to explore the possibilities of improvement of nutritive value of the plant foods. Studies were mainly concerned with the quantitative and qualitative improvement of proteins, vitamins such as β-carotene and nicotinic acid, nature of carbohydrates in rice and pulses and some antinutritional factors such as tannins and oligosaccharides. Results of these studies are presented and discussed in relation to the specific nutritional problems.

Rice and Wheat :

Cereal proteins in general are deficient in lysine content to varying extent. The quality of rice protein is highest among cereals since its lysine content is higher than any other cereal proteins. One main disadvantage of this cereal, however, is its lower protein content. Large variations observed in protein content of rice varieties reported by several workers (1, 2, 3) suggest that it is possible to select varieties of rice with high protein content. It is of interest to note that among the several high yielding and promising varieties analysed, the protein content of ADT—27 was as high as 11.3 g% (4).

In certain parts of India, varieties of red rice are preferentially consumed. Protein content of these varieties was generally higher than that of white rice (Table 1). One variety of red rice ADT-21 was found to be exceptionally high in methionine content (2.8 g/16 g N) also (5). It has been shown repeatedly that pulse proteins which are high in lysine content compensate for lysine deficiency of cereal proteins. Diets based on cereals and pulses are, therefore, not deficient in lysine but are found to be deficient in sulphur amino acids. In this respect identification of varieties of pulses as

well as cereals with high methionine content like ADT-21 has considerable practical significance.

The high yield potential of the new rice varieties is mainly attributed to their efficient utilization of nitrogen fertilizer. Studies on rice varieties (6) have shown that with increasing dosage of nitrogen fertilizer there is a linear increase not only in grain yield but also in grain protent content (Fig. 1). Increasing the dosage of nitrogen fertilizer, therefore, could be yet another approach for increasing the protein content of rice grain. These studies have further shown that the types of responses in terms of grain yield and protein content with increasing levels of nitrogen fertilizer vary with the rice genotype (Table 2). HR-67, a tall Indica rice showed a positive response only in terms of protein content with little change in grain yield. On the other hand, in the case of IR-8 with increasing levels of nitrogen fertilizer, the protein content of the grain was constant but the grain yield per unit area enhanced significantly. The rice variety C-6725 showed a significant positive response both in terms of grain yield and protein content. It is obvious that from economic and nutritional points of view, it is useful to breed varieties of rice like C-6725.

Inverse relationship :

High protein content is generally associated with decrease in lysine content of the protein in most of the foodgrains resulting in their poor protein quality. This inverse correlation appeared to be quite significant and steep in maize, sorghum and pearl millet (7, 8, 9). These foodgrains are already poor in lysine content as compared to rice and wheat proteins. Breeding for higher-than-normal protein content therefore cannot be recommended for these foodgrains.

In case of rice, decrease in lysine content of the protein as a result of increase in protein content of the grain is marginal and the quality of the high protein rice is not affected significantly (6). This observation based on chemical analyses is supported by the rat feeding trials also (10). It has been shown that the amount of utilizable protein from high protein rice was significantly higher than from low protein rice.

In wheat also, there exists an inverse correlation between protein and lysine content of the protein (11). However, the reduction in lysine content is not very marked to be of any consequence as far as the quality of protein is concerned. This was further confirmed by feeding trials in rats. Four varieties of wheat with different protein content (10 to 14 g%) with lysine content varying in a small range (2.47 - 2.60 g/16 g N) were fed at 90 % level in

the diet to weanling rats (12). It was observed that despite the variation in protein content, the net protein utilization (NPU) of the four varieties was not significantly different from each other (Table 3). These studies therefore, have indicated that as in the case of rice, wheat can also be bred for higher protein content without any significant loss of the protein quality of the grain.

Sorghum : Proteins and amino acids :

Screening for high lysine content of the protein would perhaps be a better approach for improving protein quality of sorghum and maize However, investigations in experimental animals and human subjects have shown that excess leucine in the protein of sorghum is responsible for the nicotinic acid deficiency which results in the disease, pellagra, in sorghum eaters (13,14, 15). Identification of low leucine in addition to high lysine sorghum varieties would be a logical solution to the nutritional problems associated with this millet consumed by large segments of the population. Screening of sorghum varieties, from World Germ Plasm collection has shown that genetic variability in protein, lysine and leucine content of the protein is very large (Table 4). An inverse correlation between protein and lysine content and positive correlation between protein and leucine content of the protein observed in these varieties of sorghum (8) has further suggested that the possibilities of having all the three desirable traits, namely, high protein, high lysine and low leucine content in a single variety of sorghum are remote.

Both genetic and environmental factors are known to determine the nutrient composition of the food. Eight sorghum varieties were grown under identical cultural practice at three locations. Protein content and the amino acid composition of the protein in these varieties were found to be altered by the locational factors (Table 5). At Karad, a location in Maharashtra State, the protein content of the grain was about 40-50 percent lower than the values observed at other two locations for the same sorghum varieties (16). These observations, therefore, suggest that varieties identified for high protein, high lysine or low leucine content during the screening of germ plasm collection, should be grown under different agroclimatic conditions and tested for the constancy of the characters for which they are selected and then can be used with certain confidence in breeding programmes.

Out of some 22 varieties identified, in the initial screening only four maintained stable, low leucine character (below 11 g per 16 g N) (Table 6). Experiments in dogs have shown that sorghum proteins containing less than 11 per cent of leucine do not lead to nicotinic acid deficiency in the animals

(17). The four selected varieties, therefore, are non-pellagragenic. Use of these varieties in breeding for high yielding and non-pellagragenic sorghum would be of practical significance.

Ethiopian high lysine sorghum :

Recently two Ethiopian sorghum varieties were identified for their high protein and high lysine content (18). Analysis of grain sample of these varieties grown under Indian conditions not only confirmed their high protein and lysine content but also showed that their nicotinic acid content was about 2 to 3 times higher than the normal sorghum grain (19). Although leucine content of these varieties was not low, the significance of high nicotinic acid of the grain (Table 7) is obvious. The two Ethiopian varieties, however, have a poor plant type and the grains are shrivelled and highly pigmented. The economic value and consumer acceptance of these varieties, therefore, is very poor.

Several bold and plump grain, promising Indian sorghum varieties were crossed with the two Ethiopian sorghums to combine the high yield with the high protein, high lysine and high nicotinic acid character. The cross progeny was screened for desirable plant and grain characters as well as for nutritional characters of the grain. It was observed that the nutritionally desirable characters viz. high lysine and high nicotinic acid contents were associated with the shrivelled grains in the progeny. Only three selected lines of the cross between CSV–5 and Ethiopian sorghum IS 11167 had somewhat highest lysine content with marginal increase in nicotinic acid content over that of the Indian parent. The desired plant type with lysine content of the grain protein equal to that of the Ethiopian parent may perhaps be obtained with better mating systems.

β-carotene and tannin content of sorghum :

Dietary deficiency of vitamin A is one of the serious public health problems. The yellow pigment β-carotene present in some foodgrains is a precursor of vitamin A. Analysis of several yellow endosperm sorghum varieties of Indian and exotic origin has shown significant varietal differences (20) and some Nigerian varieties had very high β-carotene content (Table 8). Such varieties, if used, augment dietary intake of vitamin A.

Polyphenolic compounds known as tannins are present in the testa layers of many foodgrains. Sorghum grains of some varieties contain very high amounts of tannin which is shown to affect the biological value of the proteins (21,22) and availability of iron (23). Commonly consumed sorghum

grain samples show wide variability in the tannin content. Very few varieties were found to contain tannin more than 500 mg per 100 g. Over 90 per cent of the varieties had tannin content below 200 mg, a level which is not likely to affect the quality of grain protein. This was especially true of some local and high yielding varieties (Table 9). Studies on iron availability have also shown that these levels of tannin are safe (24).

Pulse Proteins :

Pulses are known to be rich in protein, in which sulphur containing amino acids are the most limiting. Varietal differences in protein and amino acid content are wide and locational factors are also known to affect the nutrient composition of the pulses (25,26). The wide variability in protein and sulphur amino acid content (Table 10) could be exploited to upgrade nutritional quality of the commonly consumed Indian pulses.

Carbohydrates in pulses :

Apart from protein quality, two more aspects which need consideration are the digestibility and cooking quality of pulses. Both are possibly related to the nature of the carbohydrate component. *In vitro* studies have shown significant differences in the digestibility of carbohydrates of the pulses (27). The rate of amylolysis, a measure of carbohydrate digestibility, was found to be highest in green gram and lowest in Bengal gram (Figure 2). Variations in starch and amylose content in the varieties of pulses are very large (Table 11). High polymerisation of the amylose component of Bengal gram starch perhaps is responsible for its low rate of amylolysis and hence poor digestibility.

It is common experience that consumption of pulses leads to flatulence. Precise nature of factors responsible for the flatus formation is not fully understood. However, some oligosaccharides of the raffinose family are present relatively in large quantities in pulses. Human digestive system lacks the necessary enzyme α-galactosidase to hydrolyse these oligosaccharides (28). Interaction between the microflora of the large intestine and undigested oligosaccharides appears to result in gas production. Studies on oligosaccharide composition of different pulses have shown that all of them contain high amounts of these sugars (Table 12) and varietal differences are very wide (29). Bengal gram which is believed to induce more flatulence than other pulses, had higher amounts of raffinose. On cooking, increase of oligosaccharides (especially in stachyose and verbasiose fraction) is significantly higher in Bengal gram. This indicates that these sugars are possibly present

in free and bound form in the grain. On the other hand, prior germination- a common household practice, leads to a significant decrease in the oligosac, charide content of the pulses (Figure 3). By 48 – 72 hours of germination, practically 90 per cent of the oligosaccharides are degraded. Apart from other nutritional advantages, consumption of sprouted pulses, therefore, is less flatus inducing. Until such time low oligosacharide varieties are developed, use of germinated legumes appears to be a method of choice against the unpleasant problem of flatulence.

In conclusion, it can be said that the nutritional problems associated with plant foods are varied in nature. While breeding for high productivity of these foodcrops, improvement in their nutritional quality is possible. Concerted efforts in this direction by nutrition and agricultural scientists would bring about considerable improvement in the nutritional status of the suffering masses for whom the food is SUPREME.

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TABLE 1

Varietal Differences in Nutrient Composition of Rice Varieties

Variety	Protein g%	Lysine	Methionine	Threonine
		g per 16 g N		
		(Mean moisture content 7.5 %)		
White rice				
Taichung N–1	7.9	3.60	2.29	3.75
Taichung 65	9.6	2.94	1.70	3.32
ADT–27	11.3	2.88	1.89	3.32
IR–8	9.4	2.84	2.11	3.11
HR–67	9.9	2.97	2.12	3.30
		(Mean moisture content 12.1 %)		
Red rice				
BR–19	10.3	2.70	1.69	2.81
Jaddu–1061	10.2	2.93	1.95	3.12
RH–244	10.2	2.62	2.00	2.97
FR—13A	10.3	2.75	1.91	3.00
Manchung	11.5	2.40	1.50	2.62
ADT—21	8.1	2.03	2.64	3.58

TABLE 2

Grain Yield and Protein Content of Rice Varieties in Response to the level of N – Fertilizer

	HR—67		IR—8		C—6725	
N kg/ha.	Yield T/ha.	Protein g%	Yield T/ha	Protein g%	Yield T/ha	Protein g%
0	4.5	7.0	4.2	6.8	4.4	7.4
50	5.6	7.6	5.4	6.7	5.2	8.2
100	6.1	7.8	7.3	6.9	6.7	8.7
150	6.2	8.3	8.4	7.6	7.7	9.2
200	6.6	8.6	7.9	8.6	9.2	10.1
250	6.5	8.8	7.5	7.4	9.0	12.5

TABLE 3

Net Protein Utilisation (NPU) of Wheat Varieties with High and Low Protein Content

Variety	Protein Content		Lysine	Food intake	NPU
	Grain	Diet	g/ 16 g N	g.	%
Sharbati sonora	14.4	10.3	2.47	79	48.5 ± 3.63
Sonora 64	13.9	10.2	2.47	76	47.3 ± 3.75
URL—LF—CW 2001	11.6	9.8	2.54	70	52.6 ± 3.83
URL - LF - CW 5002	10.8	10.1	2.66	72	52.9 ± 3.12

TABLE 4

Frequency Distribution of Protein, Lysine and Leucine Content in 332 Sorghum Varieties

		Protein %		
Range	∠ 9.99	10 — 11.99	12.0 — 13.99	14 and above
%	15.6	42.1	31.3	10.8
		Lysine g/16 g N		
Range	∠ 1.49	1.5 — 1.99	2.0 — 2.49	2.5 — 2.75
%	23.5	50	25.3	1.2
		Leucine g/16 g N		
Range	∠ 8.99	9 — 10.99	11 — 12.99	13 and above
%	7.2	42.2	41.6	9.0

Coefficient of correlation

Protein vs. Lysine : - 0.333 (P ∠ 0.01)

Protein vs. Leucine : + 0.135 (P ∠ 0.02)

TABLE 5

Locational Differences in Protein and Amino Acid content of Sorghum
(Values are average of 8 varieties)

Location	Protein	Lysine	Leucine	Tryptophan	Methionine	Isoleucine
		g per 16 g N				
Coimbatore	10.5	2.30	14.3	0.96	1.99	5.51
Karad	6.4	3.14	16.7	1.29	2.78	6.04
Parbhani	11.2	1.98	12.7	0.82	1.81	4.57
C. D. 5%	0.70	0.521	0.93	0.071	0.050	0.430

TABLE 6

Varieties of Sorghum Selected for Low Leucine Content

IS No.	Location and Year		Protein g%	Lysine	Leucine
				g per 16 g N	
8298	Delhi	1967	13.5	2.25	10.6
	Dharwar	1971	14.8	—	—
	Navasari	1971	12.0	1.71	9.3
182	Delhi	1967	11 7	2.26	9.7
	Dharwar	1971	9.7	1.55	10.0
	Navasari	1971	16.1	1.73	10.4
199	Delhi	1967	11.2	2.30	10.0
	Dharwar	1971	9.8	1.58	9.3
	Navasari	1971	12.8	1.87	10.6
516	Delhi	1967	8.3	2.40	8.7
	Dharwar	1971	11.9	1.44	9.0
	Navasari	1971	11.2	2.20	8.5
4642	Delhi	1967	7.4	2.40	8.7
	Dharwar	1971	11.4	1.99	10.8
	Navasari	1971	9.2	2.22	9.2

TABLE 7

Nicotinic Acid Content of Indian and Ethiopian Sorghum

Pedigree	Grain Type	Nicotinic acid mg/100 g
Ethiopian sorghum		
IS 11758	Shrivelled	10.5
IS 11167	Shrivelled	11.5
Indian sorghum		
CSH — 1	Plump	2.9
PJ — 160	Plump	3.2
G — 1	Plump	4.9

TABLE 8

β-Carotene Content of Sorghum of Indian and Exotic Origin

Origin	β-carotene μg/100 g
Indian	2.0 — 6.0
Texas	10 — 60.0
USA	7 — 23.0
Mexico	8 — 39.0
Nigeria	17 — 97.0

TABLE 9

Tannin Content of Local and High Yielding Varieties of Hybrids of Sorghum

Local		High yielding			
Pedigree	Tannin mg/100 g	Varieties	Tannin mg/100 g	Hybrids	Tanning mg/100 g
BP 53	20	CSV – 1	117	CSH – 1	154
Aispuri	87	CSV – 2	20	CSH – 2	144
PJ 160	87	CSV – 3	216	CSH – 3	65
PJ 16 K	188	CSV – 4	39	CSH – 4	46
K – Local	215	CSV – 5	27	CSH – 5	85
U – 3	275	CSV – 6	97	CSH – 6	65
G – 4	362	CSV – 7	15	—	—
Mean	176		68		98
+ SE	± 45		± 19		± 22

TABLE 10

Range of Protein, Amino Acids and Vitamin Content of Common Indian Pulses

	Bengal gram (27)*	Red gram (13)	Green gram (16)	Black gram (11)
Protein g %	13.1 — 19.1	20.3 — 25.3	25.2 — 30.3	26.2 — 28.8
Methionine g/16 g N	0.9 — 1.4	0.9 — 1.5	0.9 — 1.2	1.3 — 1.5
Tryptophan ,,	1.0 — 1.6	0.4 — 0.6	0.9 — 1.3	0.8 — 1.3
Lysine ,,	5.1 — 6.4	5.2 — 10.8	5.9 — 6.9	6.3 — 7.0
Niacin mg/100 g	0.17— 0.29	0.19 — 0.21	1.2 — 1.9	1.4 — 1.8
Riboflavin ,,	1.0 — 2.7	2.0 — 2.6		

* Number of varieties

TABLE 11

Carbohydrate Make up and Degree of Polymerisation of Amylose in Common Indian Pulses

	Total carbohydrate g %	Starch g %	Amylose in starch g %	Degree of polymerisation
Bengal gram	61.2	46.8	45.8	1667
Red gram	61.2	53.6	35.0	667
Green gram	58.7	48.2	38.6	540
Black gram	63.7	47.7	43.9	4000

TABLE 12

Variability in Oligosaccharide Content of Food Legumes

Food legume	No. of varieties	Raffinose g %	Stach +Verb. g %	Total g %	% increase on cooking	
					Raff.	Stach+verb.
Bengal gram	8	0.8 — 3.0	0.8 — 1.8	3.0	83	105
Red gram	12	0.3 — 1.8	1.2 — 3.6	2.8	84	65
Green gram	7	0.2 — 0.8	1.8 — 2.6	2.8	40	68
Black gram	9	0.3 — 0.8	0.6 — 1.8	1.8	60	30

GENERAL RESPONSE PATTERN FOR GRAIN YIELD AND PROTEIN CONTENT OF HIGH YIELDING RICE VARIETIES TO N FERTILISER

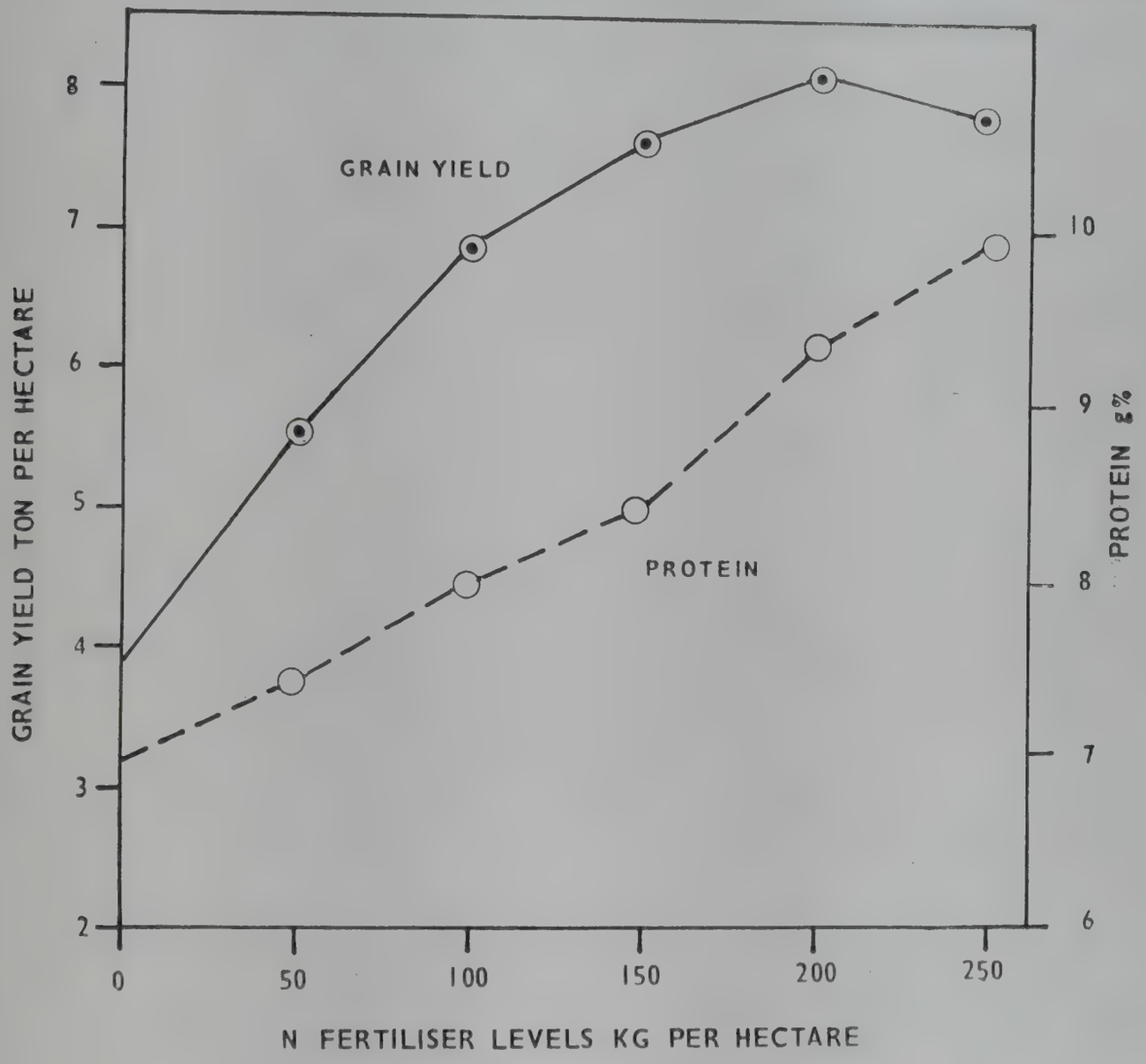

Figure. 1.

α-AMYLOLYSIS OF PULSES

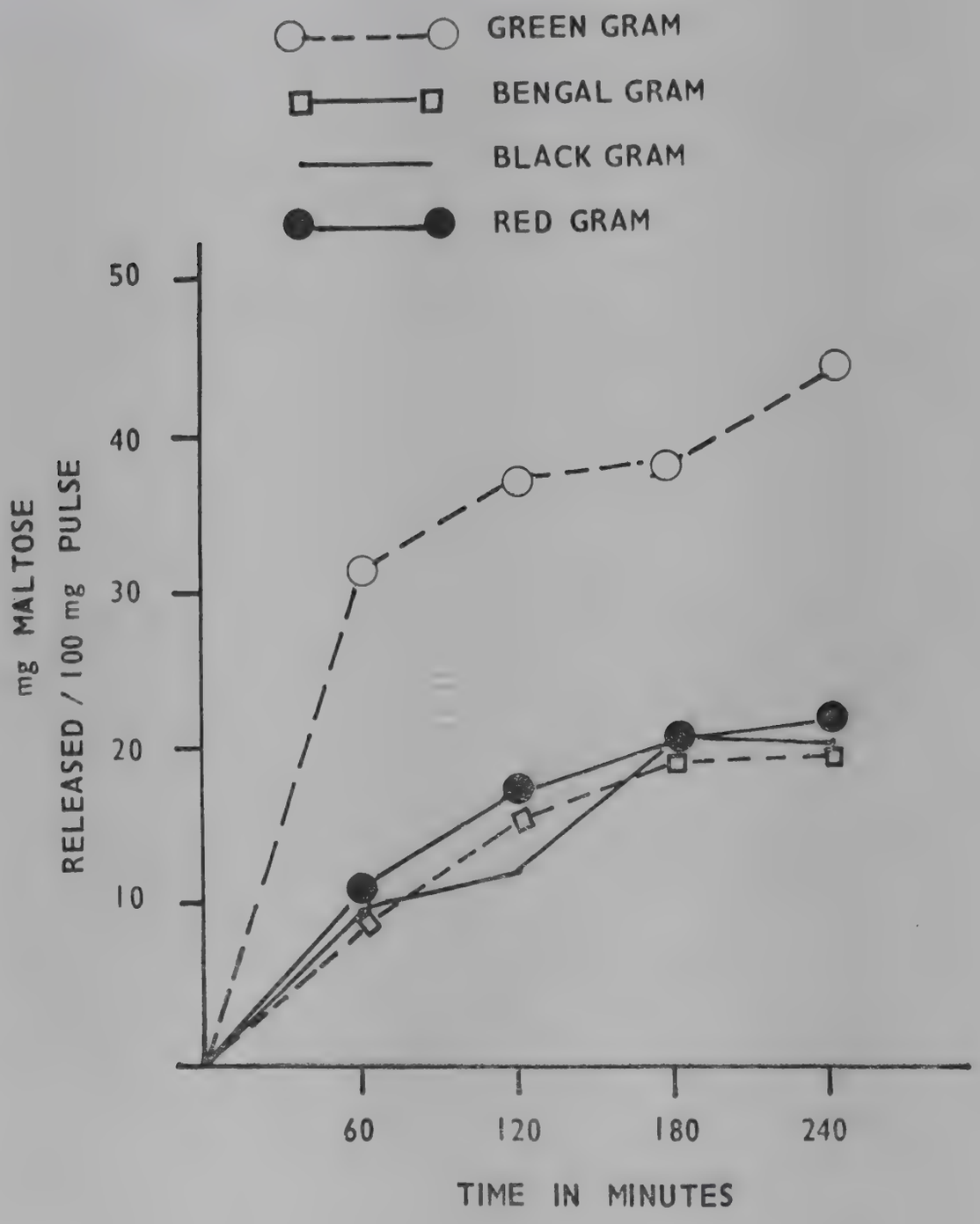

Figure. 2.

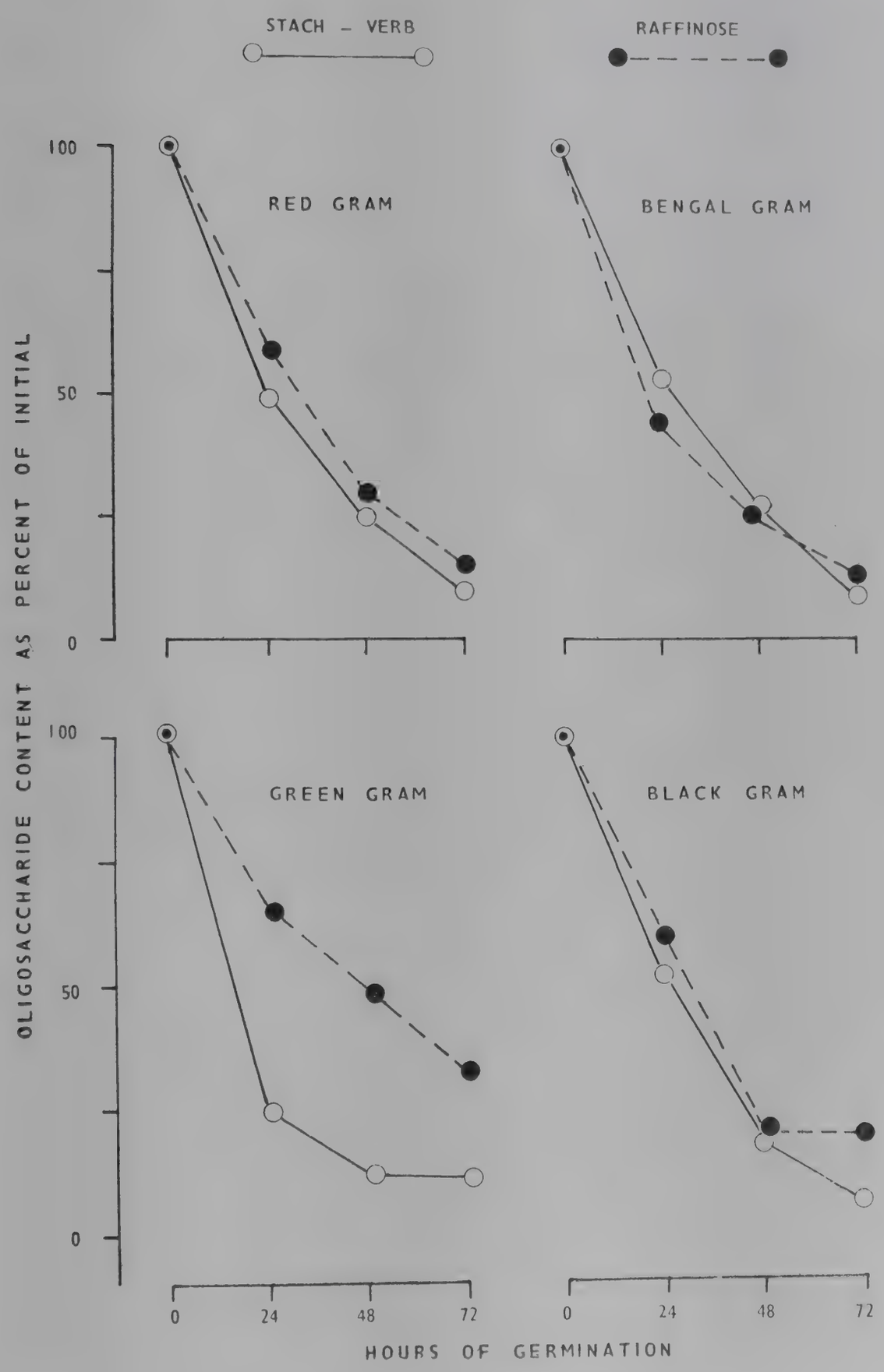
GERMINATION EFFECT ON OLIGOSUGARS IN PULSES
STACH – VERB
RAFFINOSE
RED GRAM
BENGAL GRAM
GREEN GRAM
BLACK GRAM
OLIGOSACCHARIDE CONTENT AS PERCENT OF INITIAL
100
50
0
0
24
48
72
HOURS OF GERMINATION

Figure. 3.

Discussion

The following salient points emerged during the discussion :

1. More attention should be paid to research on the quantity, method and time of application of fertilizers and their effect on grain ripening and nutritive value.

2. All testing for quality stability must include the nutrition profile of the products.

3. Cost benefit analysis must be done regarding inputs for increasing the protein content of grain vis-a-vis complementing cereals with pulses for increasing protein intake.

4. Possible effect on increased protein content in wheat and its chapati making quality must be studied in depth.

SESSION - II

Monday, July 21, 1980

Chairman : **Mr. A. V. Venkataraman**
Vice Chancellor
Tamil Nadu Agricultural University, Coimbatore.

Rapporteur : **Dr. Y. G. Deosthale**
Senior Research Officer
National Institute of Nutrition, Hyderabad.

Strategies for increased Production of Cereals and Millets

Dr. M. V. Rao
Project Director
All India Coordinated Wheat Improvement Project,
Indian Agricultural Research Institute, New Delhi.

Introduction :

The diverse soil and climatic conditions of India support a variety of crops that include finer cereals like rice and wheat and important coarse cereals like sorghum, pearl millet, maize, barley and other minor millet crops of the *Sataria* and *Paspalum* species. Some of these crops are more important than others in particular areas depending upon the food habits of people and, the limitations put by the climate, soil and different biological agents like pests, diseases etc. India is a major foodgrain producer in the world - areawise it is first in rank for rice, fourth for wheat, first for sorghum, first for pearl millet and fifth for maize in the world. India also holds second rank in the world for area under irrigation. With the recent green revolution and plans for bringing in more area under assured water supply, the contribution of cereals to India's total food-grain production in particular and world food situation in general is expected to go up further. India has all the potentialities to become one of the main producers of food in the world.

Distribution of cereals and millets in India :

Rice is the major cereal crop with about 36.8 mill ha. under it and, it is grown practically all over the country in all the States. Wheat, the next important cereal (22.2 mill. ha.), is also more or less grown all over India although its cultivation is more extensive and intensive in the northern part of the country. The cultivation of sorghum (16.1 mill. ha.) pearl millet (11.3 mill. ha.) and minor millets is more common in peninsular, central and western India. Maize is more common in the northern parts of the country including the Himalayas although in recent years it is spreading with high promise in eastern and peninsular India also. Barley is restricted more to poor and problem soils of north India. Scientific research in recent years has shown

that maize and sorghum which are traditionally *khariff* crops can be very profitably grown as *rabi* crops, for example maize in States like Bihar, West Bengal, eastern U. P., Karnataka, Tamil Nadu and sorghum in Maharashtra, Karnataka, Gujarat and Andhra Pradesh.

Area, production and yield per unit area :

Data on the area, production and yield/ha. of foodgrains (total) and, cereals and pulses separately for the period 1951–52 to 1978–79 are given in Table 1. The increase in foodgrain production mostly came from the cereals over the three decade period. The increase is both due to increase in area as well as in yield per hectare. While the area went up from 78 to 104 mill. ha. the yield per hectare went up by 100%.

Figures for area, production and yield per hectare for important cereals and millets are given in Table 2.

It would be of interest to note the changes that occurred during the three decade period. The period after 1965 coincides with the availability and cultivation of semi-dwarf, high yielding varieties of rice and wheat as a result of which these crops showed significant advances in area, production and yield/ha. While high yielding varieties and hybrids for other crops were available, the increases were not as marked as in wheat. It is estimated that the additional wheat produced as a result of wheat revolution between 1967-68 and 1979–80 period costs about Rs. 16000 crores.

Low yields:

Although the yield per hectare, of rice and wheat, doubled or trebled, the yields of India are still some of the lowest in the world. While in 1978 the average yield/ha. for rice in India was 1.4 tons, it was 6.2 in Japan, 6.0 in Spain, 5.5 in Australia and United Arab Republic and 5.0 in U. S. A. Similarly, in the case of wheat as compared to 1.5 tons/ha. of India, the yields are 5. 4 for Belgium, 5.1 for United Kingdom, 3.5 for Mexico, 2.1 for U. S. A. and 1.9 for U. S. S. R. This low productivity per unit area applies to other cereal crops also. Low levels of inputs, rainfed agriculture on large areas, early maturity of the crops, non-availability of sufficient quantities of seed of improved varieties or hybrids, inability of many farmers to take advantage of the latest technology, are some of the causes for low yields in India. The *khariff* crops have inherent handicap of many cloudy days, erratic monsoon, poor fertilizer utilization, pests, diseases etc. When farmers are able to give the needed inputs, yields of 5 to 6 tons/ha. are quite common. The potentiality for high yield of Indian crop varieties and hybrids is clearly

demonstrated by the data of National Demonstrations and All India Crop Competitions (9 -16 tons/ha.). The average yield/ha. of thousands of National Demonstrations conducted in farmers' fields with different cereal crops is a little over 4 tons. Thus, there is a big gap between what is *being* obtained and what *can be* obtained under Indian agricultural situation. This is at once the greatest and most important critical factor that should be exploited for raising our foodgrain production.

The spread of high yielding varieties and area under irrigation are other factors why in some crops there is more advance than others (Table 3).

Although hybrids which are capable of giving high yields are produced in case of pearl millet, maize and sorghum, their spread is limited due to paucity of seed. The price policies and the cost benefit ratios in fertilizer usage are in favour of some crops and this is the reason why their area and production are going up.

Demand and production:

The per capita availability of foodgrains in India is very low. As per the recent F. A. O. report, in the developed world the annual per capita consumption of cereals is about 1000 kgs. out of which only 135 kgs. are consumed directly and the rest through the animals, while in the developing world the consumption is 175 kg. only all of which is consumed directly. The availability of foodgrains is greatly affected in case of India by the population increases as seen in Table 4.

Although foodgrain production went up from 69.3 mill. tons in 1961 to 107.9 mill. tons in 1976, the per capita availability of the grain remained more or less stationary. Hence the stabilisation of population at a particular level is critical for improving the food economy of the country.

Food needs of the future :

The National Commission on Agriculture did extensive analysis of the food production prospects of the country at different periods of time upto 2000 A.D. (Table 5). To achieve the targets, foodgrain production shall increase by 58 % till 1984–85 and 121 % by 2000 A.D. Among the foodgrains, wheat is expected to record the highest increase at both points of time. These targets are sought to be achieved by mostly raising the productivity of each of the cereals per unit area, through multiple cropping, and reallocating the area under different crops, bringing in more area under assured water supply and by increasing the area wherever feasible through reclamation of problem soils.

For example, about 7.0 mill. ha. are at present reported to be under alkaline/saline conditions. The targets to be achieved in terms of yield/ha. of each of the crops as fixed by the National Commission on Agriculture are given in Table 6.

Potentialities for yield per unit area :

The production levels achieved by progressive farmers and in National Demonstrations are indicated in Table 7. Even though these high yields are not repeatable in many cases, it may be seen that potentiality exists for achieving high yields under intensive management.

Strategies for increasing production :

There are several ways by which cereal grain production could be increased under Indian conditions. These are briefly indicated below:

1. There should be a National will to achieve the targetted production goals.

2. A block–by–block analysis should be made to identify factors that are limiting production. After this critical analysis, suitable remedial steps should be taken up on a war footing.

3. Since there is a limitation for expansion of area under each crop, emphasis should be given and, infrastructure developed, to increase productivity per unit area. Productivity could be raised by giving the needed inputs and through genetic upgrading of the existing genotypes by improving their harvest index, disease/pest resistance etc.

4. Reclamation of saline/alkaline and other problem soils and putting them under stable and remunerative crops.

5. Diversification of areas, crops according to their productivity in specific areas and specific seasons. Wheat in eastern India and rice in western India are examples of how crops can cut across traditional belts, through proper thought and planning. Similarly *rabi* maize and jowar are to be taken up extensively for cultivation in areas where their cultivation is profitable. *Rabi* maize is giving 40–60% more yield in *rabi* season in some areas as compared to some of the traditional *rabi* crops.

6. Stability in yielding ability has to be continuously built into the new varieties. This involves breeding varieties/hybrids that are resistant to different diseases, pests, nematodes and soil and climatic aberrations.

7. Genotypes are to be produced that are broadly adapted to different levels of management. For example, in a multiple cropping system, early maturing varieties are needed. However, earliness is generally associated with comparatively low yield. Similarly farmers often do not get the inputs in time and in needed quantities. Hence varieties which are very specific in adaptation do not succeed under these different conditions.

8. Wherever possible, intercropping, relay and multiple cropping systems should be followed to produce more and diverse food in a given area. This may include cereals vs. pulses, cereals vs. oilseed crops, also.

9. One of the major losses to fooodgrains is through post harvest handling of the crops at harvest, transport, threshing, marketing and storage. It is estimated that 10% of India's foodgrains are lost in storage and other post harvest operations. If this loss is controlled, it is a saving to the tune of nearly 13 mill. tons as per the 1979 Production figures.

10. Weeds have become one of the major menaces in intensive agriculture. Some of them have proved so serious that crop losses even upto 30-40% are being experienced. It is urgent that losses due to weeds are controlled or minimised.

11. A dynamic extension network is a must to reap the benefits of research. Many a good research findings do not find application in the fields because of lack of efficient extension service.

12. Favourable public policies are a must to promote production. The wheat revolution in India is an example to quote. Favourable incentives in the form of procurement prices, subsidies for necessary inputs, making available needed inputs at the needed time etc. go a long way to encourage production.

13. Rainfed agriculture should receive concerted efforts. Inspite of development of major irrigation projects, considerable parts of the country will still continue to have large tracts under rainfed conditions. For each crop, appropriate high yielding varieties, correct package of production and protection technology have to be developed and popularised.

14. Certain amount of mechanisation of agricultural operations suited to the socio-economic conditions, peculiar to different regions of India is a long overdue input. Mechanisation will facilitate timely operations, saving of time, assuring correct seeding, population stands, spraying of chemicals, harvesting and storage of produce.

15. Nutritional quality of the grain should receive high priority in our research now. We have reached level of self - sufficiency in certain cereals and there is every chance for us to become surplus. While the quantitative aspects of cereal needs can be taken care of with the new high yielding varieties and the production and protection technology already developed, the nutritional needs require increased attention now. The protein levels, the amino acid balance and the quality needs of different end-products manufactured by industries require our close attention now. Till crops like Triticales, which have got high protein and high lysine are accepted for human consumption, they can be used for strengthening feeds of animals and poultry. This applies to opaque-2, floury–2, maize and high lysine millet, sorghum and barley types also.

16. India has all the needed ingredients to become a major producer of foodgrains if the research and production efforts are appropriately channelised. Certain quantities of cereal foodgrains like rice, wheat, etc., can be exported. In addition to foodgrain and products for export, there are greater opportunities and chances to produce seed of improved varieties for exporting purposes. If careful thought is given to this aspect and exports are promoted without hurting the local needs, this will be a good incentive for production.

17. Lastly, basic research on different aspects of crop prodcution, protection and quality which is a continuous process to sustain production in the long run, is a necessary adjunct to production efforts. Basic research on new plant types, responsiveness to different pests and pathogens, soil nutrients etc., should be strongly supported and encouraged to sustain the cereal production efforts.

TABLE 1

Area, Production and Yield of Cereal, Pulses and Total Foodgrains

A Area : Mill. Ha.
P Production : Mill. tons
Y Yield/Ha : Kgs.

Year	Total cereals			Total pulses			Total foodgrains		
	A	P	Y	A	P	Y	A	P	Y
1951—52	78.2	43.5	557	18.8	8.4	448	96.9	51.9	536
1961—62	93.0	70.9	753	24.2	11.8	539	117.2	82.7	710
1971—72	100.5	94.1	936	22.1	11.1	501	122.6	105.2	858
1975—76	103.7	107.9	1041	24.4	13.0	533	128.2	121.0	944
1976—77	101.4	99.8	985	22.9	11.4	494	124.4	111.2	894
1977—78	103.6	113.8	1099	23.5	11.8	501	127.1	125.6	988
1978—79	104.5	118.5	1124	25.5	12.0	470	128.1	130.5	1019

Source : Economics and Statistical Adviser, Deptt. of Economics and Statistics, Ministry of A & AC, New Delhi.

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TABLE 2

Area, Production and Yield/H of Selected Cereal Crops

Area : Mill. ha.
Production : Mill. tons
Yield/ha : Kgs.

Year	Rice			Wheat			Jowar			Bajra			Maize		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1951—52	29.8	21.3	714	9.4	6.2	653	15.9	6.1	381	9.5	2.3	246	3.3	2.1	627
1961—62	34.7	35.7	1028	13.6	12.1	890	18.2	8.0	440	11.3	3.6	323	4.5	4.3	957
1971—72	37.8	43.1	1141	19.1	26.4	1380	16.8	7.7	460	11.8	5.3	452	5.7	5.1	900
1975—76	39.5	48.7	1235	20.4	28.8	1410	16.1	9.5	591	11.6	5.7	496	6.0	7.2	1203
1976—77	38.5	41.9	1088	20.9	29.0	1387	15.8	10.5	667	10.8	5.8	544	6.0	6.3	1060
1977—78	40.0	52.7	1377	21.2	31.3	1477	16.3	11.8	726	11.0	4.7	427	5.7	5.9	1043
1978—79	36.8	53.8	1462	22.2	34.9	1572	16.1	11.6	720	11.3	5.5	487	5.7	6.2	1088

Source : Economics and Statistical Adviser, Deptt. of Economics and Statistics, Ministry of A & AC., New Delhi.

TABLE 3

Percentage Area Under Irrigation and H.Y.Vs

Crop	Percentage cropped area irrigated (1976)	Percentage area under H.Y.V. (1977)
Wheat	61.4	69.4
Rice	38.0	34.5
Pearlmillet	6.0	21.3
Maize	15.0	18.3
Sorghum	5.0	15.2

TABLE 4

Population of India and Per Capita Availability of Cereals

Year	Population in millions	Cereal grain production (mill. tons)	Per capita net availability of cereals (Kgs./Year)
1961	442.4	69.3	145.9
1966	493.2	62.4	131.4
1971	550.8	96.6	152.4
1976	609.3	107.9	147.2
1981 (Estimated)	661.4	125.6	—
1985 (Estimated)	725.0	142.0	—
2000 A.D. (Estimated)	935.0	195.0	—

Source : Fertilizer Statistics 1978-79

TABLE 5

Estimated Production of Important Cereal Crops (Mill. tons) (1985 & 2000 A.D.)

Crop	1978–79	1985	2000 A.D.
Rice	53.8	61.0	80.0
Wheat	34.7	41.0	50.0
Coarse cereals	30.0	40.0	50.0
Total cereals	118.5	142.0	195.0
Pulses	12.0	22.0	35.0
Total foodgrains	130.5	164.0	230.0

TABLE 6

Area, Yield/Ha. and Production Targets of Cereals to be Achieved by 2000 A. D.

Crop	Area (Mill. ha.)	Yield/ha. (tons)	Production (Mill. tons)
Rice	32.0	3.04	97.2
Wheat	17.55	3.64	63.8
Jowar	17.0	1.20	20.4
Bajra	12.0	1.25	15.0
Maize	9.0	2.65	23.8
Ragi	2.50	2.1	5.2
Small millets	2.0	0.75	1.5
Barley	5.5	1.97	10.8
Oats	0.5	4.0	2.0
Total cereals and millets	98.05	—	239.7

TABLE 7

All India Crop Competitions — Highest Yield Obtained (Yield in Tons/Ha.)

Year	Paddy	Wheat
1967—68	10.5	10.3
1969—70	14.2	12.4
1971—72	15.3	7.6
1973—74	17.7	14.0
1975—76	16.7	13.7
1976—77	11.9	10.8

Source : Indian Agriculture in Brief, 17th Edition. Deptt. of Economics & Statistics, Min. of A & AC, New Delhi.

Discussion

While recognizing the phenomenal increases in yields and production of cereals like rice and wheat, the view was expressed that more attention must be given to increasing the yield potentials of millets – both major and minor. This would help in stabilizing the overall foodgrain production in the country.

Strategies for Increased Production of Pulses*

Dr. Y. L. Nene
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ICRISAT, Patancheru, Hyderabad-502 324

Traditionally pulses have been an important constituent of the predominantly vegetarian diet of the people in India. The total production at present is around 12 million tons obtained from over 23 million hectares, giving a low average yield of around 500 kg per hectare. Our current need for the pulses has been estimated at 17 million tons and this calls for urgent measures to increase production. More research efforts in developing cultivars with increased genetic yield potential and built-in stability by way of resistance to different stresses are required.

Promising results have been obtained in recent years in increasing yield of pigeonpea by using hybrids and in chickpeas by modifying plant type, and in stabilizing yields of several pulse crops by incorporating genetic resistance to diseases. Further innovations in the traditional cropping systems are needed to increase overall production.

Insect pests are particularly damaging to pulses and some farmers will benefit from a judicious use of insecticides. For the many others who are not able to use insecticides effectively, alternative pest management strategies have to be developed. Steps to effectively transfer the presently available technology by way of availability of good seed, effective and realistic yield demonstrations, training of personnel, etc., need to be implemented more seriously. Present incentives offered to farmers need to be continued and additional ones introduced.

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*Since full text of the paper was not made available, we are constrained to print the abstract.

Discussion

The following salient points emerged during the discussion:

1. More attention must be given to milling technology in respect of pulses.
2. Losses due to insects during storage must be minimised.
3. Cultural planning for specific areas must be intensified.

Strategies for Increased Production of Oilseeds

Dr. A. C. Chhatrapati
The Vanaspati Manufacturers' Association of India, Bombay.

Since the focus of the theme of this workshop is on nutrition and strategies in agricultural development, our first consideration should be to examine nutritional goals and estimated requirements of fat for our population. The Study Group of the Planning Commission on "Reliable estimates of supply and demand for oils and fats" has the following information on the nutritional goals.

Estimated requirements :

As per the computations of the F.A.O., 30 per cent of our total intake of calories should come from fats. With one gram of fat giving 9 calories, and our current daily per capita intake of about 1800 calories, the requirement of fat comes to 60 grams or 22 kg of oils and fats per annum. Assuming a population of 67 crores in 1980–81, the requirement of edible fats works out to 15 million tonnes. The Indian Council of Medical Research (ICMR) has, however, suggested a minimum intake of fat at 15 percent of dietary calories. This would bring down the demands for fat to 7.5 million tonnes.

According to biochemists consumption of 1 gram of fat is necessary for every kilogram of body weight. Assuming that the average human body weight in India is 40 kilograms, the fat requirement will be 40 grams per capita daily or 10 million tonnes annually.

Our fat intake as per one estimate is 24 grams per day comprising 15 grams from visible oils and fats and 9 grams as invisible fat. To sustain this rate of consumption of visible fats we need 3.7 million tonnes in 1980-81.

Oilseeds are a valuable source of protein. But the production of pulses is not keeping pace with our growing population, and there is a need for exploiting oilseed protein for human consumption.

In recent years availability of oils and fats including edible oils, vanaspati and ghee has been around 3.5 to 3.8 million tonnes. However, we have achieved this level of consumption by importing edible oils at the rate of 1 to 1.3 million tonnes a year since 1977. Earlier, consumption had to vary from year to year depending upon the indigenous production of oilseed crops as imports were marginal.

Meagre consumption:

It is obvious that compared to even the modest goal set by ICMR, our per capita consumption is only about 50 per cent. World annual consumption of visible oils and fats is currently estimated at 12.5 kg per head. Thus, by world standards too our fat consumption is meagre.

As an economist, I would suggest that we should consider the nutritional goals as an ideal long term objective. In short and medium terms, we have to take into consideration purchasing power of the people to see that what is or can be produced will be consumed. In fact it has been the experience of the farmer that despite such poor rate of consumption, in years of bumper crops like 1967-68, 1970-71 and 1975-76, the prices of edible oilseeds and oils had declined to uneconomic levels.

Oils and fats are used for industrial purposes too as in making soaps, paints, lubricants and olio-chemicals. As oil industry and trade are largely unorganised, no reliable estimates of fat uses separately for edible and industrial purposes are available.

According to F.A.O. and some of the expenditure surveys of National Sample Survey, the demand for oils and fats in India increases at the rate of 1.2 times the increase in per capita income. Hindustan Lever recently estimated that current demand for vegetable oils is of the order of 45 lakh tonnes and it will raise to 55 lakh tonnes in 3 more years. Another estimate by Tata Economic Consultancy Services projects the demand for all purposes at 42 lakh tonnes in 1980 and 53 lakh tonnes in 1985. If supply does not increase sufficiently the cruel economic law will equate it with demand through rising prices. You may have to pay soon as much for oil as you are paying for ghee today.

Bridging the gulf:

The indigenous output of both edible and non-edible oils from all sources has been fluctuating between 25 and 30 lakh tonnes in recent years. Milk fat production is stagnating at about 6 lakh tonnes. The cost of production of milk fat is high. It will, therefore, continue to contribute only a

small and decreasing proportion of total fat consumption as has been the experience of all advanced countries.

We are thus faced with a formidable task of first bridging the wide gulf between our current domestic output and the established meagre level of demand. Economic Survey of 1980-81 has aptly described the current status of oilseed production and the immediate task before us.

It states, "The economy is faced with stagnant production of oilseeds and pulses. Slow growth of oilseed production has led to a heavy reliance on edible oil imports. Approximately a quarter of our total requirements have to be imported and the value of imports is comparable to the value of food imports in earlier years ..... While such policy was feasible when the balance of payments situation was easy, it cannot be continued for long in view of the problems created by rising petroleum prices."

That oilseed production is stagnant will be evident from the following comparative figures of compound rates of growth in production, area and yields between 1952-53 to 1964-65 and 1967-68 to 1978-79 excluding the exceptional drought years of 1965 and 1966 :

Crop/Group of crops	Production		Area		Yield	
	1952—65	1967—79	1952—65	1967—79	1952—65	1967—79
Foodgrains	2.52	2.77	1.07	0.44	1.12	1.84
Groundnut	4.65	1.47	3.78	—0.15	0.84	1.60
Rapeseed and mustard	3.28	1.73	2.93	1.07	0.34	0.65
Oil seeds	3.46	1.62	2.80	0.25	0.37	1.26
Nonfood-grains	3.87	2.88	2.31	1.19	1.24	1.25
All crops	2.90	2.81	1.31	0.63	1.21	1.63

Oilseed growth was better than foodgrains and all crops in the first period and exceeded the rate of growth in population. Hence there were no shortages of edible oils and some exports were allowed in good crop years. However, in the second period the growth rate in oilseeds lagged well behind that in the population and was significantly lower than the growth rates in cereal and all crops.

The high rates of oilseed growth in the first period was largely due to the significant rise in its area. In the second period, the area remained

stagnant. On the other hand, oilseed yields were nearly stagnant in the first period but showed some progress in the second period. Productivity increase may be attributed largely to the replacement of rainfed *Kharif* areas by irrigated summer areas in southern States for groundnut and the spread effect on mustard of fertilisers, irrigation etc. used on wheat crops, as mustard is grown mixed with wheat on a large scale.

Green Revolution

Economic survey attributes the success in food production to the agricultural strategy adopted in the late sixties with its emphasis upon introduction of better quality seeds, accompanied by emphasis on the use of other inputs like fertilisers, irrigation and improved cultivation practices. It states that similar efforts of introduction of improved varieties, supply of quality seeds, adoption of improved cultural practices and introduction of oilseeds as part of the multi-cropping system in irrigated areas have not achieved notable success. Efforts to introduce non-traditional oilseeds like soya bean and sunflower have yet to bear fruit.

To those familiar with oilseeds research and extension efforts, this failure is no surprise. Investment in research and extension effort in relation to the size of the crops involved has been meagre. For example, despite the critical shortages of edible oils since 1966, the investment in oilseed research in the fourth Five Year Plan was merely Rs. 4 lakhs per crop per year and even in the draft sixth Plan it was just Rs. 10 lakhs per crop per year. When one considers that the nine oilseed crops cover nearly 17 million hectares scattered in widely different agro-climatic conditions presenting different problems, one cannot but help to conclude that there really was too little effort to expect any breakthrough.

No single research station in the country has built up experience and expertise in specific crops largely due to frequent transfer of research staff. Despite all Expert Committee recommendations and establishment of Agricultural Universities, this baneful practice continues. Centres of excellence for oilseed research are just being established.

Extension is a State subject. The efforts of State Agricultural Departments tend to concentrate in areas where liberal Central aids are available. They also seek to take credit where improved seeds and other inputs are readily available. High yielding varieties in grains and cotton naturally attracted their maximum attention.

National and State Seed Corporations have been most reluctant to multiply, stock and sell improved varieties of oilseeds. Being commercial, they can cover their very high overheads and make profit only in sale of hybrid seeds or seeds of vegetables which can fetch high prices and high yielding varieties of grains where remunerative procurement prices assure high demand from farmers. Research stations having new oilseed varieties find few corporations interested in multiplying. Curiously, the generous Central subsidy on sale of groundnut seed has also not so far succeeded in attracting the State Seed Corporations.

Benefits denied:

Consequently, as Economic Survey points out, dual benefits of technological breakthrough and remunerative procurement prices maintain comparative advantage in favour of wheat, rice and sugarcane and the gains from new irrigation get pre-empted by these crops. No wonder despite high oilseed prices, hardly 7 per cent of the total area under oilseeds enjoys the benefit of irrigation when nearly 30 per cent of the total cropped area of the country has irrigation. Recently, groundnut has been losing ground to rice both in Punjab and in Tamil Nadu as irrigation spreads. The strategy for increasing oilseed production will have to overcome these constraints.

Appropriate strategies:

Research effort should be strengthened many fold with specific result-oriented objectives. For groundnut we need varieties of short duration (90-100 days) for Punjab, Haryana and Uttar Pradesh with short monsoon season; short duration varieties responding to irrigation and fertilizers for multi-crop irrigated areas to assure incomes comparable from rice, cotton and sugarcane; cultivars richer in oil and protein as existing ones seem to have deteriorated in both; and for some regions varieties resistant to aphids, tikka and rust.

For rape and mustard, early varieties to suit short winter conditions of Bengal, Bihar, Orissa and parts of Gujarat, Rajasthan; high oil content exceeding 40 per cent as in Canada; hybrids to improve yields which assure returns comparable to wheat to attract irrigation and other inputs.

Sunflower which is an oilrich seed with low cultivation cost and short duration, failed to catch on as varieties suitable for our conditions were not developed. New varieties like Morden and hybrid BSH - 1 are promising. Several more to suit various climatic conditions are needed.

Safflower is a traditional crop of great potential as a sequence crop in dry areas depending on soil moisture. Varieties with oil content exceeding

40 per cent as in the U.S.A. and Mexico, and resistant to aphids can help to popularise it on a large scale.

The current levels of technology and consequent yields for linseed, sesamum and niger are primitive. They deserve attention as they are grown largely in drought-prone, poverty stricken regions.

Drought-resistant varieties for drought-prone areas can help to stabilise oilseed production.

Research support :

The basic breeding work will have to be accompanied by research to evolve specific agronomy for ensuring optimum yields. Currently, many good cultivars become unacceptable as farmers are not told of their specific needs. For example M-13 variety of Punjab is a high yielder only if it is sown with pre-irrigation to ensure maturity by October end.

Problem-oriented research to tackle loss of plants from whitegrub, termites, fungal diseases etc. in specific regions needs urgent attention.

Agricultural engineering research to evolve suitable seed drills, inter-culturing and harvesting implements to facilitate new cultivation practices too deserve priority.

Research results will take time. With mounting deficits in our balance of payments we must increase oilseed production quickly to substitute the heavy imports and sustain the present level of consumption. The task is formidable but not insurmountable.

Our yields are so low that adoption of the existing knowledge of improved cultivation practices can increase production by about 40 per cent as shown by results of the National Demonstration programme. Our experience in the Vanaspati Manufacturers' Association extension activity is similar. What is needed is purposive, relentless effort to persuade farmers to adopt these practices on a large scale and help them overcome some of the problems of inputs, marketing etc.

The following are pre-requisites of such extension effort ;

1. Large scale supply of improved seed ;

From the experience of high yielding varieties of cereals and cotton, the farmer has become conscious of the importance of discarding traditional practices and adopting the recommended newer ones if new varieties are to

yield more. Thus, a new variety is crucial to acceptance of new practices like changing row spacing, increasing plant population, putting sufficient fertilizers, plant protection measures or protective irrigation.

There are sufficient good varieties available which, if multiplied on large scale and taken to new areas, can increase yields significantly.

Recently, we supplied the established J-11 seed from Gujarat to Andhra Pradesh with package of practices like line sowing and use of fertilizers. The crop cutting results show increase of 20 to 40 per cent in different regions. Similarly TG-3 variety has performed outstandingly well in Orissa, Karnataka and Madhya Pradesh and M-13 in Uttar Pradesh and some districts of Maharashtra and Andhra.

2. *Adequate price support and procurement guarantee* :

Present support prices of oilseeds are too low to induce farmers invest in inputs required for increasing yields. Remunerative prices have been crucial to the rapid expansion of wheat, rice and sugarcane. The present support price of Rs. 1900 per tonne for groundnut would yield an oil price of Rs. 5.70 per kg when Government is selling much cheaper imported oils to consumer at Rs.8 per kg in wholesale. The realistic groundnut support price for this price of oil comes to Rs.2700 per tonne. Unless the support prices are raised to such level and backed by an effective procurement programme, farmers will not take up groundnut instead of paddy or sugarcane under irrigation. Procurement guarantee is also necessary for acceptance of new varieties of seed. Currently, private trade exploits the farmer if colour or size of the kernel is different from the local variety and pays 25 per cent less than the ruling price. Without procurement guarantee oilseed prices decline to uneconomic levels if crops are bumper as in 1968, 1971, 1976.

Rapid expansion of soyabean cultivation in recent years has been entirely due to a reasonable support price and active buying by NAFED. Such support is required for introducing oilseed crops in new areas too.

3. Assured input supply :

Rapid multiplication of improved seeds is crucial to increase production of oilseeds. Seed Corporations and private agencies will have to be encouraged to meet this need. Credit is another major input as investment in seed, fertilisers, pesticides etc. is high. Further, oilseeds are often grown in drought-prone areas and when crops fail, credit facilities for the next crop are a prime need. Crop insurance can mitigate this need.

4. *Effective communication* :

We have yet to make radio communication as an effective communication agent in extension. Daily broadcasts from local radios by experts keeping in touch with crop conditions informing farmers of steps to be taken to improve productivity or protect plants from pests and diseases or adverse climate can go a long way to increase production.

5. *Extensive cultivation* :

As irrigation spreads, multicropping opportunities increase. Effective steps of localisation of area for specific crops and extension education can help to introduce groundnut as *kharif* crop and mustard as *rabi* in the Rajasthan Canal area and groundnut or sunflower as summer crop in southern and eastern regions.

Even in dry areas there is considerable scope for introducing safflower as a second crop where soil moisture is good. Our experiments have shown that safflower can yield 2 to 8 quintals without much effort in Madhya Pradesh, Orissa, West Bengal, East Uttar Pradesh and Bihar. Similarly, sesamum can be taken as a spring crop in Assam, Bengal and Bihar. Sunflower, as a short duration, drought-tolerant crop, offers great opportunity of protecting farm incomes in drought-prone areas when grown as a mixed crop.

There is enough knowledge. The new Central Budget promises generous funds. Now the State extension agencies must rise to the occasion.

Oilseeds are rich in protein too. With suitable changes in technology we can upgrade oilseed meal from animal feed to human food. Hydraulic pressing of groundnut kernels to extract 80-85 per cent oil and restore seed to original shape through steaming and similar inexpensive technologies may have better scope than protein isolates and textured protein foods. Larger human use of oilseed meals will improve the economics of oilseed growing.

Discussion

The following salient points emerged during the discussion :

1. An important requirement is research into the breeding of varieties of oilseeds resistant to fungal damage and less toxin producing ones.
2. Oil from rice bran should be fully exploited soon and before the rancidity sets in. Only 10% is now being used for oil extraction out of 1,20,000 tonnes of bran available.
3. Right genotypes and plant protection efforts are the lacunae.
4. Marketing facilities and assured price support would act as incentives.

SESSION - III

Tuesday, July 22, 1980

Chairman : **Dr. P. G. Tulpule**
Director
National Institute of Nutrition, Hyderabad

Rapporteur : **Dr. V. Jagadeesan**
Research Officer
National Institute of Nutrition, Hyderabad

Nutrition Oriented Agricultural Production*

Dr. H. K. Jain
Director
Indian Agricultural Research Institute, New Delhi.

It has been widely recognised that a great deal of malnutrition in developing countries like India results from the shortage of calories in the diet. Protein malnutrition which has received so much attention in recent years is also now recognised to be largely a function of shortage of calories. An increase in the per capita availability of calories should therefore go a long way in eradicating this problem. Cereals and pulses have been traditionally the only concentrated source of protein for most people in countries like India. During the last 15 years, agricultural research programmes in India have therefore given highest priority to the development of high yielding varieties of cereal crops like wheat, rice, maize, sorghum and millet.

In the case of cereal crops like wheat and rice, work during the last 15 years has helped to almost double the genetic potential for productivity through a genetic reconstruction of the plant type, using some newly discovered genes like the *Norin* 10 mutations in wheat and the *Dee-Gee-Woo-Gen* dwarfing source in rice. In coarse cereal grains like maize, sorghum and millet, heterosis breeding has led to the development and release of a large number of high yielding hybrids which are now beginning to have a major impact on production.

The plant type concept which has been so successfully exploited for the improvement of cereal crops is now being extended to pulses and oilseeds. The strategy has been to reduce the maturity duration of these crops and make them relatively photo-and thermo-insensitive so that they can be fitted in a wide range of multiple and inter-cropping patterns with the cereal crops. This approach makes it possible to shift pulses and oilseeds to areas of

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*Since full text of the paper was not made available, we are constrained to print the abstract.

improved agronomic management without a great deal of competition with the cereal crops. The genetic improvement of foodgrains for protein content and quality has been achieved firstly through a discovery of a number of major genes (such as the opaque-2 gene in maize and the hiproly mutation in barley) which help to improve the amino acid balance and secondly through attempts at breaking the negative correlation between grain yield and the protein content of crops like wheat and rice. For the first time improved crop varieties and genetic stocks are being evolved which offer the possibility of combining high grain yields with a larger harvest of protein.

A discussion session after Dr. H. K. Jain (extreme left), Director, Indian Agricultural Research Institute, New Delhi, presented his paper in Session III of the Workshop on Agricultural Strategies.

Discussion

The following salient points emerged during the discussion :

1. Since calorie gap is a major problem, apart from other efforts, more attention must be given to intensify research on tubers and increase their availability.

2. The small farmer must be brought into the mainstream and it must be ensured that he makes use of the advances of technology.

3. After the foodgrain breakthrough, attention must be given to develop plant varieties which can yield higher amounts of limiting nutrients such as calcium and β-carotene.

Consumer Acceptance of new varieties of Foodgrains

Dr. P. Geervani
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Consumer preference, acceptance and practice are related terms. While preference is only a consumer's subjective reaction, acceptance indicates willingness to use. Practice relates to what is actually done. Acceptance varies with living standards and cultural background. Preference refers to selection when given a choice, and it is influenced by prejudice, group conformance, status value, in addition to the quality of food.

Pre-requisites for acceptance:

Acceptance of a new variety of foodgrains is a problem of recent origin. Two decades ago, varieties produced were limited and only whatever was accepted was produced. Acceptance depends on (1) the attitude of the consumer, and (2) the sensory stimuli derived from the food. Responses to food are learnt by experience and food habits influence food likes and dislikes. The development of acceptance of a wide variety of food is desirable and should begin early in life. Even unfamiliar foods are accepted more readily in a pleasant atmosphere than under conditions of stress and pressure.

Acceptability of new varieties is important from the view point of market price. Poor man's purse may be different but not the palate. Hence a slight reduction in the cost of new varieties may not be the deciding factor while purchasing a new variety. But slightly more palatable variety will be preferred by the consumer even if it is a little expensive. Hence consumer acceptability assumes importance in view of several new varieties being released. As good and poor are relative attributes, qualities accepted by one cultural group may not be acceptable to the same degree by another cultural group.

There is no grain quality which can be considered universally good or bad. There is a range of qualities between these two. Overall supply and purchasing power also determine consumer preference for a staple grain. Preference may get shifted with increasing purchasing power and vice-versa. There are certain minimum or optimum quality characteristics that are preferred in each foodgrain and if the new varieties have these optimum qualities, in course of time, it will find consumer acceptance. Adaptation depends on availability and price,

Who should accept ?

"Consumer" is a rather wide term which encompasses people of all categories irrespective of socio - economic standards. For whom should the grain be acceptable ? Poor, middle or high income group ? Since it is only recently that consumer acceptance is being given consideration, to which category of consumers should the grain be acceptable is an important aspect to be looked into. Most of the traditional varieties were accepted in the regions of production. With the release of several high yielding varieties, grains produced in one region have to find acceptance of a consumer in a far off region also. Qualities of such grain are initially unfamiliar to the consumers.

It is mostly the semi - urban and urban people who purchase the grain rather than rural people. Being cheaper, staples distributed through fair price shops, meet with the special preference of the consumers by adaptation. There are, however, no data on market survey about the acceptance of grains distributed through fair price shops. Such an exercise may reveal some information on what qualities are not accepted, even if the grain is sold at the cheapest cost.

All consumers do not prepare the grains in a similar manner. Equal attention must also be given to ascertain the specific products in respect of which the grain is acceptable. Consumers' acceptance alters with storage. Some grains such as rice may improve in quality and therefore more acceptable after storage and some may deteriorate in quality eg. pearl millet.

What does a consumer assess?

At the first stage, it is more a visual assessment of quality based on size, colour, amount of foreign matter, mold contamination etc. Later, it is the cryptic characteristics like weight, hardness, density, swelling capacity, yield, keeping quality and texture of cooked product which are assessed. Finally, it is the overall taste, palatability and keeping quality which are

judged as the consumers eat frequently. Even if the visual characteristics are not rated on par with some of the varieties traditionally accepted, if the cryptic characteristics and palatability are good, the consumer accepts the grain. In spite of a good visual appeal if it is rated poorly for taste, the consumer's preference will gradually change. Generally, the cryptic characteristics coincide with overall palatability. Palatability itself is a measurement of many factors like colour, texture, consistency and taste. Hence, while attempting for qualitative improvement, efforts at improving the cryptic characteristics and palatability will produce fruitful results. That is the reason why certain grain varieties have enjoyed the consumer preference over several decades.

Factors influencing the acceptance:

(a) Sensory qualities: Appearance and flavour are the first factors judged. Once the product is tasted, colour and texture are examined. The reasons cited most often for disliking a given good is that it does not taste good.

(b) Regional preference: Preferences differ from region to region, depending on food habits.

(c) Age and sex: Preferences of adults are different from those of other age groups.

(d) Other factors: Interest, motivation, discrimination, intelligence etc. also influence acceptance.

Methods of testing acceptance:

Acceptance can be tested by observational method or questionnaire method. In the observational method, consumer is watched in the market at the time of purchase, It is possible to know whether the consumer looks for a specific quality, price, or plans to buy a particular variety. The discussion that the consumer has with the seller also reveals some information. Observation of the per capita comsumption of a given variety can be also done.

In the questionnaire method, questions are designed to collect information on the variety preferred, consumed, frequency and form of consumption, reasons for the choice, whether it is his first choice etc. If the sample available is limited then a trained panel of judges are used. Such tests are done at the laboratory level. All the three methods are subjective methods. In the questionnaire method it is only the preference that is indicated but not the difference. In testing by a trained panel, the product/variety is graded or

scored and the difference is also pointed out.

Certain objective tests have also been standardised for assessing each grain. Adequate and reliable tests are developed for rice and wheat but not for millets because the method of preparation of rice and wheat products are standardised unlike those for millet products.

Tests or assessing cooking quality of rice :

1. *Physical characteristics* :
   - i) (a) Size
     (b) Hydration characteristics
   - ii) Expansion and bulk density
   - iii) Pasting characteristics of rice

2. *Chemical characteristics*:
   - i) Amylose
   - ii) Alkaline susceptibility
   - iii) Protein

3. *Palatability characteristics* :
   - i) Colour
   - ii) Cohesiveness
   - iii) Flavour
   - iv) Tenderness
   - v) Appearance
   - vi) Taste

Wheat qualities ;

With wheat production exceeding 30 million tonnes, India is on the verge of becoming a wheat surplus nation. But functional parameters in relation to utilisation in bakery products are yet to be stabilized. Three characteristics generally considered for judging the functional properties of wheat/flour are (1) Physical characteristics; (2) physico-chemical characteristics and (3) sensory properties.

1. Physical characteristics ;
   - (a) Colour
   - (b) Hardness, size, shape of grain
   - (c) Presence of foreign matter and mold.

2. *Physico-chemical characteristics* :

(a) Granularity of flour - particle size

(b) Microscopic examination - number of broken cells.

(c) Water uptake

(d) Weight and volume of gluten before and after expansion.

(e) Dough development time

(f) Peak viscosity of dough

(g) Sedimentation test - (volume of sediment read after 5 minutes of suspension in dilute lactic acid isopropanol mixture.)

(h) Measuring changes in viscosity of flour water suspension with the addition of lactic acid – It provides information on the hydration capacity.

(i) Diastatic activity : Expressed as α -amylase activity.

3. *Palatability quality* :

This differs from product to product. Texture, colour, flavour, appearance and overall quality are assessed. Weightage given for each property differs for each product. In some, crispness is desirable, in others sponginess etc.

Cooking quality of millets :

There are no systematic studies on the consumer preference of millets. Except for maize, other millets have not received attention with respect to improving consumer preference as they have remained as the food of the poor. There is lack of information on the different forms in which millets are consumed and on methods of preparation. In some regions they are consumed in the form of *roti* made from whole meal flour. In certain regions the whole meal flour is cooked with water to a semisolid consistency or made into balls (dumplings). Some times the batter is even fermented before cooking. Broken rice or rice is also used in combination with millet flour for such preparations. In some regions it is soaked for a few hours in water, dehusked by hand pounding husk is winnowed and the grain cooked to a soft texture like rice. It is called jowar rice, bajra rice and so on. The form of consumption reflects a food habit. The question of non - acceptance arises when the grain variety produced/sold in the region is not suitable for making the products generally consumed in that region. The characteristics of the grain might be suitable for one type of preparation and not for all. For example, grains with thinner husk are suitable for milling into whole meal flour used for *roti*. These

grains are generally soft and flour made from such grains has less bran and outer husk, hence it readily blends for rolling into *roti*. These grains will not be suitable to prepare rice as it will tend to break during handpounding. For rice, grain with thicker husk is more suitable. Hence qualities preferred differ from region to region.

Millets have a distinct and strong flavour. People who dislike the taste actually dislike the flavour. Colour is not such an important characteristic that is valued provided the overall palatability is good.

1. *General physical characteristics that can be used for assessment* :

Grain size, colour (white, yellow, red), shape (round) presence of mold and foreign matter.

2. *Cryptic characteristics* :–

(a) 100 seed weight ;
(b) easiness with which dehusking can be done ;
(c) dry volume ;
(d) volume after soaking
(e) flour granularity
(f) swelling capacity ;
(g) breakage while rolling or ability to spread into as thin a *roti* as possible;
(h) water absorption and retention after baking
(i) time taken for cooking (only in moist cooked products).

3. *Overall palatability characteristics valued in order* :

Flavour (taste) Colour Texture Absence of stickiness Absence of furrows Taste Colour Flavour Keeping quality	Rice and semisolid

Improving grain quality by processing :

1. *Semi refining flour*

Semi refined flour can be obtained after sieving coarser husk. If the grain is sprinkled with water, allowing imbibition of water for 20 minutes, it

enables production of flour with minimum amount of husk/br
for *roti* such flour will be good.

2. Pearling :

Pearling is a process by which the bran or husk is removed. The grain is equilibrated with 2 to 5 % moisture, so that the bran can be scraped off using abrasive devices. By handpounding, the moisture is equilibrated in the grain, the bran is loosened which can be winnowed and removed. Mechanisation of this process will reduce the drudgery of preparation of the grain. Abrasion of the bran by suspending in aqueous alkaline solution which allows the grains to float is also followed. Bulk of crude fibre can be removed by pearling. It is suitable for sorghum, maize as well as bajra.

Flaking, puffing, and extruding have also been tried on commercial scale to improve the quality of the coarse grains.

Techniques to improve consumer preference of coarse grains :

1. Addition of boiling water for making the dough.
2. Incorporation of wheat flour at 30-40 % level.
3. Fermenting batters and making wet pan cakes (*dosas*).
4. Development of crisp products after deep frying has been found to yield acceptable products, particularly for bajra.
5. Combining oilseed flour like groundnut and gingelly also contributes certain amount of stickiness which prevents breaking up of dough while preparing *roti*.
6. Parboiling of maize as well as ragi has been found to improve the texture of cooked products. Parboiled maize rawa has excellent quality for upma. Parboiled ragi flour eliminates stickiness in cooked ragi dumpling and introduces a little grittiness into the products and improves consumer acceptability.
7. Malting/germinating has also been found to release easily digestible sugars and improve flavour. Malting is a traditional practice which can be revived and also introduced for other coarse grains.

Cooking quality of legumes :

Per capita consumption of legumes is low in India owing to the high cost. The generally consumed legumes are red gram, Bengal gram and green gram. Forms of consumption differ for each legume and also from region to

region. Largely they are consumed after boiling. Boiled dhal is mashed into puree and cooked with tamarind juice and seasoning. Sometimes dhal is cooked with green leafy vegetable and mashed. Unlike cereals and millets, dhal is not consumed as it is without the inclusion of other foods and spices. Hence the overall acceptance of the dhal preparation depends upon the combination and method of preparation. However, there are certain grain characteristics which are looked for by the consumers.

1. Physical characteristics :
   - (a) Grain size, and shape.
   - (b) Presence of foreign matter and mold.
   - (c) Uniformity of colour or number of discoloured samples.

2. Physico-chemical characteristics :
   - (a) 100 kernel weight and volume.
   - (b) Water absorption on soaking.
   - (c) Cooking time.
   - (d) Bulk density after steaming.
   - (e) Total solids dispersed in aqueous extract after boiling.
   - (f) Viscosity of aqueous extract.
   - (g) Percent increase in weight and volume after boiling.
   - (h) Phytate phosphorus % } for whole gram
   - (i) Tannin % }
   - (j) % solids after passing through a standard sieve(20 mesh) after mashing.
   - (k) Alcohol insoluble solids.
   - (l) Brine flotation - for fresh peas.
   - (m) Sugar/acid ratio for fresh legumes.
   - (n) Fibre content.
   - (o) Susceptibility to infestation.
   - (p) Viability (for whole gram only.)
   - (q) Proportion of starch to protein.

3. *Palatability characteristics* :

The sensory properties looked for are listed in order. These can be tested both by consumer studies or by using a panel of trained judges.

Flavour
Colour

Appearance
Texture
Taste

Factors influencing consumer acceptance :

1. Population sampled
2. Amount of pilot testing
3. Method of sampling, amount of replication, size of statistical error etc.
4. Correct interpretation of data.

Limtiations of consumer studies :

Inability to remember, to generalise, to describe likes/dislikes.
Unaware of what influenced their behaviour,
Desire to please the interrogator.

Discussion

The following salient points emerged during the discussion :

1. Mere verbal attitudes of a consumer cannot give any clue as to the acceptance of the product. He must be given the product and his evaluation must be taken note of.

2. Since modifying food habits is a difficult task, wherever possible familiarisation through institutionalised feeding etc., might help the consumer in taking decision,

Strategies in Poultry and Piggery Development

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The Animal Husbandry sector has a very important role to play in stepping up of animal protein production. Poultry development and piggery development show the greatest potential for augmenting animal protein food production in the shortest period of time.

Poultry Development :

Poultry are part of farm and home in Indian villages and are most popular. Through intensification of poultry development programmes, benefits from increased protein production can be felt in every family. With the implementation of the Five Year Plans and Panchayat Raj programmes after Independence a great drive has been given for poultry development in the country. These programmes are of a multi-tiered nature to suit different locations and classes of people.

Through a programme of grading up of native birds in villages by crossing with improved high producing breeds like White Leghorn (W.L) and Rhode Island Red (R.I.R.) in a systematic manner, the productivity of the progeny could be doubled. This programme has been highly successful. Supply of units of birds belonging to W.L. and R.I.R. breeds was widely practised over the Plans to familiarise pure birds to rural people and for pure line multiplication. This was also quite popular. Under the ANP more intensive programme of poultry development in selected areas was taken up during the sixties. Under this programme young farmers were given special training in poultry farming. Special housing was provided for poultry units and also balanced feed. A proportion of the eggs was to be supplied to the government agency for distribution to preschool children and nursing mothers free of cost to improve their health. The above mentioned programmes greatly popularised poultry running in the rural areas.

Simultaneously the extension of training facilities to large numbers of youth and systematic preventive vaccination to control deadly diseases like Fowl pox and Ranikhet diseases provided the required incentive to people to take up poultry farming to supplement their income.

Self-supporting industry :

Consequent on the implementation of the programme mentioned above, over the last three decades, the poultry sector has been commercialised and has become a big industry. Today, India occupies the sixth place among the countries in the world in the poultry industry. Poultry industry is concentrated by and large in and around large cities where the market for eggs is attractive and requisite facilities for supply of hybrid chicks, feed and veterinary care are available. The poultry industry is self-supporting with a large number of hatcheries to meet the great demand for hybrid chicks, large number of feed mixing plants to provide the requirement of high quality feed, a number of equipment manufacturers and several pharmaceutical firms to meet the requirements of medicines. There are also government and private organisations to take care of the marketing of eggs. Because of this balanced growth in the poultry sector, over the last 10 years the per capita consumption of eggs has grown from about 10 to 18 per annum.

Currently, encouraged by the good returns from poultry farming and the ready availability of bank credit, a large number of educated, unemployed youth have entered the poultry industry. Government is also implementing poultry programmes supported by subsidies and loans to help weaker sections. Large numbers of farmers are also diversifying from crop production to poultry farming to supplement their income. Because of the activities mentioned above, there has been enormous growth in the poultry sector during the last ten years. However, unfortunately due to the low purchasing capacity of the average citizen, the growth of this sector has slowed down. We have the confidence to produce all the requirement of eggs in the country.

Broiler production

In the matter of producing poultry meat through broilers, till about ten years ago no special attention was paid due to the high energy requirement of meat birds leading to competition with man for foodgrains. However, after the green revolution and free availability of cereal grains, special steps were taken to popularise broiler production. But, since the price of grains is still high, broilers could only reach the homes of high income groups. During the last five years, due to the enormous rise in the price of mutton all over the country a favourable climate has developed for the marketing of meat birds.

The commercial hatcheries have also increased their production of chicks and broiler production has received new impetus. With the industrial pattern of egg and meat production, poultry industry can step up production several times in a short period to ensure adequate supplies of protein and also provide employment opportunities. The real stimulus for the further growth of this industry should come from expansion of markets through higher purchasing power of the general public.

Piggery Development

The modern pig is a veritable meat factory. An improved sow can produce about one ton of meat per annum through its progeny. A pigling can grow at the rate of 1 kg. per day on high quality rations. Pig is reputed to have the highest reproductive efficiency among farm animals. It is also most efficient among farm animals in converting food into animal protein.

Unfortunately, this efficient farm animal is not only badly neglected but even despised in this country and is used as a scavenger. The Indian pig is low in weight, has poor litter size and poor growth rate. This unfortunate situation is largely due to poor feeding management and poor health cover provided to these animals. The pig is a hardy animal and can survive under adverse conditions. In this country, pig rearing is largely within the hands of the weakest sections of society.

Restricted market

With the impact of the Five Year Plans, several programmes for the improvement of the indigenous pigs have been launched. By crossing the local sow with foreign breeds like Large White and Landrace, the litter size and growth rate of the progeny can be improved very substantially. Such programmes have been launched all over the country. However, due to lack of adequate and remunerative markets for such improved pork, this programme and other programmes for pork production on scientific lines have not moved far. Several Bacon Factories have also been established in different parts of the country for hygienic handling of the slaughter of pigs and processing of pig meat into sophisticated products like sausages, salome, bacon, ham etc. However, due to restricted markets and high cost of these products, the functioning of these Bacon Factories has not been satisfactory. The average Indian is averse to consuming pork largely because of the dirty feeding habits of the pig. The market for pork is largely restricted to the rural and poorer sections of the population who cannot afford the high price of mutton, and upper sections of society with foreign tastes.

During recent years in view of the sharp increase in the price of mutton and relatively lower price of pork, the market for pork is gradually exparding. With greater thrust in marketing and education of public, the market for pork can be rapidly expanded for the benefit of society. Extending the market for pork can also help the weaker sections of society in providing self-employment and greater income. Pig rearing on scientific lines does not require much land and this is a boon to landless farmers. China has been able to make a breakthrough in animal protein production through exploitation of the pig. In spite of the very badly neglected state of indigenous pig, a large population in this country is still dependent on pig rearing for its livelihood.

Extension and support :

The present intake of animal protein by the average citizen is indeed depressingly low and every possible step has to be taken to increase the intake rapidly to ensure the growth of a healthy child and a robust nation. Poultry and piggery sectors offer the greatest potential for the most rapid expansion of the animal protein programmes of the country and in the shortest span of time. The country has all the know-how for launching extensive programmes based on these species and the farmers also have the capacity to handle the birds and pigs. It is, however, essential to provide high quality feed at controlled prices to produce low-cost animal products and bring them within the reach of the common man. Besides, an extensive education programme has to be launched to dispel the prejudices of the public against consuming pork. Simultaneously, a dynamic marketing programme has to be initiated to take these products direct to the consumers. With assured market, we have the competence to make a breakthrough in animal protein production based on poultry and piggery development.

Discussion

The following salient points were discussed.

1. The various reasons for the spurt in mutton price were discussed including the following :

   a) lack of sufficient attention for promoting goats which are good meat yielders;

   b) export of sheep and goat to Middle East regions;

   c) successive droughts hit pastures, reducing grazing facilities for sheep and goat ;

2. More attention has to be given to logistics of egg production, particularly in terms of reducing the inputs, including overheads on transportation.

3. The possibility of exploiting insect protein in the preparation of poultry feed must be examined seriously.

Strategies in Horticulture/ Nutrition Gardens

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Fruits, starchy roots, leafy and other vegetables, herbs and mushrooms are classified as horticultural crops. Of these, only starchy roots and beans provide staple food to some people. Rest are generally known as protective foods, supplying vitamins and minerals. In respect of nutrients like ascorbic acid, they are the only or the major sources of supply.

What is generally not recognised is that they are good producers of protein per unit area (Table 1). This is for the simple reason that the protein content is expressed on fresh weight basis. To get certain amount of protein, one has to eat many times more of vegetables and fruits than pulses or cereals (Table 2). Amounts of other nutrients–vitamin A, riboflavin, calcium and iron and calories produced per acre are also very high in the case of horticultural crops. Yields are exceedingly high in respect of root crops like yams and fruits such as papaya (Table 3).

Crops like tapioca and banana are rich in carbohydrates and can reduce the demand for cereals. Except for sprouted legumes, which are sparsely used, fruits and vegetables are the only significant sources of vitamin C in human diet. Green leafy vegetables, orange roots and yellow fruits, which are relatively cheaper than animal food are rich sources of β-carotene converted into vitamin A. Utilization of β-carotene from such sources as amaranthus and papaya by the human body is good. Germ of nuts, peas and beans, all green vegetables, roots and fruits contain significant amount of B-vitamins. Calcium is found abundantly in green leafy vegetables, more so in amaranthus, fenugreek and drumstick leaves. Among root vegetables, tapioca is a good source. Green leafy vegetables are also rich in iron.

Although till recently fibre was considered only as a 'filler' or at best a mild laxative, its beneficial effect in protecting against some degenerative

diseases is slowly coming into light. Fruits and vegetables provide fair amounts of fibre and in some cases, pectin.

Present levels of consumption of vegetables and fruits are far below the suggested dietary allowances for a typical balanced diet. Result is the widespread occurrence of several deficiency diseases.

	g per capita per day		
	Leafy vegetables	Other vegetables	Fruits
(1) Actual consumption	21	71	10
(2) Suggested dietary allowances	110	125	37
(3) (1) expressed as % of (2)	19	57	27

Crop improvement :

The main emphasis in improvement of horticultural crops is on quality-colour, texture, appearance, flavour and taste. Nutrition can also find a place. It is easier to increase nutrients by the genetic than by any other means.

One of the objectives of crop improvement is to improve protein content. Tapioca and sweet potato are basic sources of energy for over 400 million calorie deficient people in Africa, South America and Asia. To increase protein content of their dishes, incorporating the combination of tubers, cereal and a pulse had been suggested. Central Food Technological Research Institute, Mysore, has formulated tapioca macaroni incorporating wheat. A better way is to improve the protein of the tubers. Better protein quality in beans and peas through increased methionine and albumin levels respectively can be aimed at.

The other objective is to improve the levels of vitamins and minerals in horticultural crops. Low level of oxalate, which reduces available calcium is desirable and similarly phytic acid, which interferes with absorption of calcium, zinc and non-heme iron should be low.

More attention should be paid to improvement of native vegetables and fruits which occupy a larger area. At present there are more breeders of grape and cabbage than of mango, drumstick and amranthus !

New crops with proven nutritional qualities can be introduced and adopted. Sweet potato varieties from Taiwan with better protein and β-carotene and lower oxalate are worthy of adoption.

Natural wealth :

India has a total floristic wealth of about 20,000 species of angiosperms, out of which only a few are cultivated. Several hundreds with edible greens, flowers, fruits, seeds and other parts grow wild. A good compilation of these plants was published recently (18). Most of these are hardy and quick growing, and some are weeds in cultivated lands. Plants like amaranthus are highly productive and photosynthetically efficient. They provide articles of diet to the tribals and occasionally to the rural population. From the limited analyses made, several of them appear to be nutritionally rich. For example, Musliblai (*Capparer horrida*), a wild leafy vegetable consumed by Riang tribesmen of Tripura, contains as much as 31 mg iron per 100 g (17). On the pattern of U.S. National Academy of Sciences Report (1975), which provided an inventory with a description of 36 under-exploited tropical plants with promising economic value including 3 roots and tuber crops, 4 vegetables and 7 fruits, a thorough screening of the wild and semiwild plants for their nutritive values and other qualities is suggested. Some of the uncommon foods like chekkurmanis are nutritious and deserve wider cultivation (Table 4). The vast germplasm of fruits and vegetables varies considerably in nutrient content and affords a good scope for selection within the varieties and types (Table 5).

Genetic manipulation :

The idea of 'locking in' more nutrients through genetic manipulation is extremely attractive. Indeed it has become a reality in some cases. Lycopene is the major carotene (upto 97 % of total), which makes tomatoes red, but has no vitamin A activity in human body. β-carotene, which has activity, is present only to a small extent (about 3 %). Genetic control of the pigment content by 3 pairs of genes is now understood and lycopene can be replaced by β - carotene (93 % β- carotene and 3 % lycopene i. e. an enrichment of β–carotene by 31 times). Similar manipulation is also possible in case of carrot. A total of 7 different genes which affect the sugar concentration of sweet corn have been discovered and used to develop 'super sweet' sweet corn. In mango, the vitamin A has been pushed up from about 9000 to 16,830 μg by hybridisation (19).

Improving production

Another strategy is to increase production, which can be brought about by increasing the area and yields per unit area, and increasing the number of crops produced per year.

Hill slopes and marginal lands can be converted more profitably into orchards. Even scrub jungles can be planted with fruits like mango and jack. Fruit plants like Seetaphal, which are not eaten by animals can be grown in waste lands adjoining villages as is the case in some Telangana districts of Andhra Pradesh. Edible species should be preferred for avenue planting. Even in farm forestry, few perennial vegetables and fruit plants can find a place.

Promotion of nutritional gardens should be extended to all educational and other institutions. Few perennials like drumstick, curry leaf and guava in the kitchen garden, which require least care, will go a long way in ensuring good nutrition to the family. Window boxes should be designed even in kitchens of flats to have a fresh supply of low growing herbs.

Due to labour and other problems, and higher economic returns, there is a welcome trend in extension of area under fruits. This can be further stimulated by exempting the orchards from land ceiling laws.

However, the technical services from the Government are not adequate. Departments of Agriculture are pre-occupied with cereals and fertilizers, and usually extension activities for horticultural crops are neglected. Starting of state departments of horticulture should improve the situation. Another limitation for extension of area is lack of availability of required numbers of quality planting material. Vegetatively propagated material can be taken up by the State Seeds Corporations.

Yields per hectare can be boosted even with the present level of technical know-how, as is evident from the glaring differences between the yield of Udyan Pandits and average yields. New approaches like dense planting should be tried in case of fruits. Dwarf plants, either natural or induced by virus or dwarfing rootstocks, will be helpful in such plantings. In multistoreyed cropping, several crops like pineapple, banana, black pepper and coconut can be grown on the same land.

Nutrition, water requirements and other aspects of many horticultural crops are not fully understood and this calls for more research effort and financing.

Post-harvest conservation :

Fruits and vegetables, being perishable in nature, are easily spoiled. It is estimated that nearly 30 % of these are wasted after harvest in developing countries due to defective handling, packing, transport and distribution. The losses include both quantitative and qualitative ones.

Early harvesting of fruits and vegetables for commercial advantage usually results in nutrient losses. To catch the early markets of North India, Andhra Pradesh orchardists harvest mango fruits soon after they attain size but long before their attaining physiological maturity. When these are force-ripened, the losses are about 20% vs. only 10% in mature fruits. Sugars, β-carotene and flavour do not attain normal levels in early harvested fruits. Pulp of Banganapally mangoes, which is bright yellow normally, does not go beyond pale yellow and the variety is called as 'Safeda' (White) in North. Guavas harvested at 'eating ripe' stage contain 179 vs. on y 163 mg/100 g of 'half ripe' harvests. (15). Plant ripe tomatoes also contain 1/4 to 1/3 more ascorbic acid than the ones picked green and ripened (11). Over-ripe fruits also may lose some of their nutrients. For example, in banana the ascorbic acid level drops from 0.111 to 0.032 mg/g when they are allowed to overripe (7).

In developing seeds of peas and beans, the phytate content goes up at the expense of inorganic phosphorus. Early harvesting ones have a lower phytate phosphorus fraction.

Bruising and damaging the tissue should be avoided while harvesting fruits.

Packaging and Transport Care :

Proper packing affords protection from contamination, mechanical damage and wilting through water loss. All these have a profound effect on nutrient conservation. Another objective is to prolong the shelf life. Rapid wilting results in quicker nutrient losses at both low and high temperatures (4 and 5). Polyethylene lining of the transporting baskets would slow down the water losses from vegetables. Little research has been done on the effect of native packages on nutrient losses.

Besides being costly, cold storage has a limited applicability due to the resulting chilling injury to tropical vegetables and fruits. Alternatives such as hypobaric and modified atmosphere storage have to be developed. The latter can be had on a small scale by storing in plastic bags. Permeability of the bag to oxygen and carbon di oxide is of particular importance. Optional gas compositions can be achieved by packing fruits and vegetables in packages with controlled permeability characteristics. Storage in bags protects the organoleptic properties and nutrient values for a longer time in several fruits and vegetables (13 and 16).

Reduction in time between harvest and consumption minimises the nutrient losses. Less spoilage was reported in mango fruits after introductior

of mango special dieselised trains which have reduced the time of transportation from 7 to 3 days between Vijayawada and Delhi.

Processing the perishables :

Sometimes it is argued that processing in tropics is not as much needed as in temperate climates where the cropping season is limited. However, it must be pointed out that except for the few lucky irrigated tracts, vast majority of rainfed areas may not have a blade of green for use as vegetable in summer. Dehydration of greens like Bengal gram and safflower leaves in the abundant tropical sun is in vogue in certain parts. Preparation of 'Varugu' from dropped mango fruits is also practised. These are the only things which the villagers use as vegetable throughout the parch dry summer. Excess production in rural areas should be preserved for their own consumption by adopting home scale methods of preservation. Pickling of fruits is widely done. It can be done even with green leafy vegetables like gongura (*Hibiscus cannabinus*) which is the practice in Andhra. Being nutritionally desirable, it deserves wider adoption. Sauerkraut is a good vitamin C supplier to European diets. Preserves of amla and lime can be used in India when no fresh sources are available.

In U. S. A. more than half of the production of fruit and vegetable is processed, while in India barely 0.4% of the total production is processed. In the larger interests of the country, Government will do well to make available requirements like cans and sugar for the canning industry.

Nutrition labelling of processed foods, which are consumed to a small extent will be a good education to the public and make them nutrition-conscious.

Although more sophisticated food processing methods like freeze drying retain a higher percentage of nutrients and there is a greater likelihood of nutrient losses when appropriate technology is used, developing countries have to contend with the latter for the present. Some of the byproducts which are not fully utilized at present can be put to better use. Mango kernels can be used for manufacture of edible, high grade fat, which can substitute cocoa butter.

Losses in preparation and cooking :

Last, but not the least in importance, is proper preparation and cooking by the housewife. As can be seen from the table (Table 6) most of the vitamins are destroyed to a large extent by improper cooking, although essen-

tial amino acids and fatty acids, and mineral salts fare better. Particular mention should be made of ascorbic and folic acids which can be destroyed completely.

Fruits are generally eaten as such or with least preparation and their nutrient values are not much altered. In contrast, vegetables generally require cooking and losses occur. Efforts should be made to minimise the nutrient losses by consuming them in as fresh a state as possible.

Losses start even preparatory to cooking. When fruits and vegetables are trimmed, the nutrient losses generally exceed weight losses, as the nutrients are found in higher concentrations in the outer leaves of vegetables and in the outer layers of seeds, tubers, roots, and fruits. Peeling of potatoes may result in 12 to 35 % loss in ascorbic acid content as it is concentrated just below the skin (20). The peel of carrots is especially rich in thiamin, niacin and riboflavin (21). Outer leaves of lettuce and spinach are rich in B vitamins and ascorbic acid (22). There is 1.5 - 3 times as much iron, 1.5 times as much ascorbic acid, and 21 times as much carotene in the green leaves of cabbage as in the bleached ones. Raw mango also has higher concentration of ascorbic acid in the peel.

Losses continue during washing, soaking and chopping, being more so during the latter. Minced cabbage and mashed potato may lose 40 % of the ascorbic acid.

Greatest retention of ascorbic acid and carotene is obtained when vegetables are cooked without added water and least retention is associated with cooking in water to cover. Losses of calcium, iron and phosphorus are similar (10). These can be reduced considerably by limiting the volume of cooking water. Since the lost nutrients are for the most part in the cooking water, utilizing the liquids is definitely worth the effort.

Losses of nutrients like thiamine, riboflavin and ascorbic acid are considerably less during pressure cooking as compared to boiling at atmospheric pressures.

It is better to delay the preparation of foods until a few minutes before they are to be cooked and served. Protracted soaking should be avoided. Salads should be prepared just before they are to be served. Sodium bicarbonate, which is sometimes added to hasten cooking and preserve colour of vegetable, reduces alkali-sensitive nutrients like thiamine and ascorbic acid.

Stereotyped cooking of vegetables, besides causing loss of nutrition, becomes least appetising. Greater consumption, particularly by the children, can be stimulated by diversified methods of preparation like salads, chutneys and juices. Incorporation of leafy vegetables into fermented batters of idli and dhokla, and snacks like bhaji will enrich them with β-carotene.

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TABLE 1

Relative Efficiency of Vegetable Foods and Animal Foods as Suppliers of Nutrients from an Acre of Land (12)

Class	Gross yield kg/acre	Approximate amount producible per acre*					
		Calories 10^5	Protein kg	Ca kg	Iron g	Vitamin A I. U. 10^5	Riboflavin g
Cereals	350	12.0	35	0.10	21.0	3.5	0.35
Pulses	250	8.6	60	0.20	20.0	2.5	1.00
Oilseeds	300	16.5	8	0.15	4.8	1.8	0.90
Milk	360	2.9	11	0.76	0.7	3.6	0.36
Animal foods+	20	0.4	4	0.05	0.4	0.1	0.06
Leafy vegetables	5000—10000	24—48	200—400	12.5—25.0	750—1500	3500—7000	5—10
Root vegetables	5000—10000	50—100	100—200	1.0—2.0	30—60	50—100	1—2
Other vegetables	2500—5000	10—20	50—100	1—2	50—100	75—150	1.5—3.0
Fruits	10000—20000	50—100	80—160	3—6	120—240	50—100	2—4
Sugar	2000	80	—	—	—	—	—

* Calculated from figures for yield and average nutrient composition of different food groups derived from values given in food tables for commonly consumed foods (Aykroyd, 1966)

+ Assuming that efficiency in the conversion of plant protein is 3:1 in the case of milk and 10:1 in the case of other animal foods.

TABLE 2

Moisture Content and Quantities Required

		(In approximate grams giving)					
	Moisture %	100 calories	10 g protein	100 g calcium	3 mg iron	1000 I. U. vitamin A	1 mg Riboflavin
Cereals	10	30	100	330	50	1000	1000
Pulses	10	30	40	125	40	1000	250
Oilseeds	5	20	40	200	200	600	30
Animal foods	75	70	40	700	150	3300	330
Egg	72	60	75	170	150	50	555
Leafy vegetables	90	200	250	40	20	15	1000
Starchy root vegetables	8	100	500	500	500	1000	5000
Other vegetables	80	250	500	250	150	330	1700
Fruits	85	b 100				d 100	
			1250	330			5000
		a 200				c 2000	

a, b fruits low and high in carbohydrates.

c, d fruits poor and rich in carotene

(Source : Rajyalaxmi R. 1974, Applied Nutrition, Oxford & 1BH).

TABLE 3

Production and Nutritive Values of Some Horticultural Crops

	Yield Kg/a	Per 100 g edible portion					
		Calories	Protein g.	Ca. mg.	Iron mg.	Carotene I. U.	Riboflavin mg
Potatoes	5,000—10,000	97	1.6	10	0.7	40	0.01
Elephant yam	10,000—20,000	79	1.2	50	0.6	434	0.07
Banana	10,000—20,000	116	1.2	17	0.9	78	0.08
Papaya	24,000—40,000	32	0.6	17	0.5	2,500	0.25

TABLE 4

Nutritive Values of Some Uncommon Foods
(per 100 g)

	Protein g	Fat g	Carbo-hydrates g	Ca mg	P mg	Iron mg	Carotene mg	Thia-mine mg	Ribo-flavin mg	Nia-cin mg	Vita-min C mg
Chekkurmanis	6.8	3.2	11.6	570	200	28.0	5706	0.48	0.32	2.6	247
Agathi leaves	8.4	1.4	11.8	1130	80	3.9	5400	0.21	0.09	1.2	169
Drumstick leaves	6.7	1.7	12.5	440	70	7.0	6780	0.06	0.05	0.8	220
Barbados cherry	—	—	—	—	—	—	—	—	—	—	1500
Winged beans	32.7	18.4	27.9	—	—	—	—	—	—	—	—

TABLE 5

Variation in Nutrient Content

Nutrient	Unit	Crop	Lower value	Higher value	Fold difference	Reference No.
β—carotene	μg vitamin A	Mango	320	16,830	52	14 19
Carotenes	μg/g	Carrots	1	200	200	6
Ascorbic acid	mg %	Barbados cherry	8.4	3,309	300	8
Protein quality (in supporting rat growth)	% of that of Casein	Peas	18	78	4	1
Methionine content of protein	% of control variety sanilac (2.44 mg/g N)	Beans	63	160	3	9

TABLE 6

Stability of Nutrients[8]

Nutrient	Maximum cooking losses %
Carotene (Pro-A)	30
Ascorbic acid	100
Thiamin (B_1)	80
Riboflavin (B_2)	75
Niacin	75
Folic acid	100
Biotin	60
Essential amino acids	5–40
Essential fatty acids	10
Mineral salts	3

Discussion

The following salient points emerged during the discussion :

1. More support to horticulturists, particularly regarding supply and method of usage of fertilisers, pesticides, is required.
2. Facilities for transportation of perishables and organised marketing through cooperatives etc., should be forthcoming.

SESSION - IV

Tuesday, July 22, 1980

Chairman : **Dr. A. Appa Rao**
Director of Research
Andhra Pradesh Agricultural University, Hyderabad

Rapporteur : **Dr. Ramesh V. Bhat**
Senior Research Officer
National Institute of Nutrition, Hyderabad

COMMUNITY HEALTH CELL
LIBRARY AND DOCUMENTATION UNIT

Strategies in Fisheries Development*

Mr. S. Banerjee
Director of Fisheries, Andhra Pradesh.

Nearly two-thirds of the earth's surface is covered by water which is a rich resource of fishery wealth. Fish has been recognised as a protein-rich food valued both in human nutrition and in the nutrition of animals on which man depends for other products.

Consumption levels :

In the developed countries the per capita consumption of fish is about 10 to 12 kgs, while it is about 700 gms in developing countries. With special reference to India, there is large scale malnutrition in most categories of people. In view of the abundance of fishery wealth and scope for development, fish is the answer to increase protein levels in our diet.

Till very recently we have been gatherers of fish and not growers. The declaration of 200 miles economic zone provides us with a ocean surface of 2 million sq.kms in contrast to the land surface of 3.29 million sq.kms available to us. But land has been sufficiently utilised both for producing food material and for habitation of animals, including man. And there is an increasing demand for food specially rich in vitamins and protein highly needed for the growth. We have therefore to look forward for the judicious exploitation of fish and other aquatic animals recognised for human and animal consumption. At the same time, we must pay due attention for growing the required varieties, both for augmenting the production and for preventing depletion in case of over exploitation.

Resources available :

Against the above background, I appraise you of marine, inland and brackish water resources available in the State of Andhra Pradesh and the various developmental activities taken up and proposed to be taken up.

Andhra Pradesh has 9 coastal districts with a coastline of 982 kms. Nellore which is the southernmost district has the longest coastline. Then

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* Paper read by Mr. B. R. V. Chalapathi, Jt. Director of Fisheries, Andhra Pradesh.

comes the northernmost Srikakulam district which is having a coastline of 102 kms. The fishery of the coastline is influenced by south-west monsoon from June to September and north-east monsoon upto October to December. Unlike in the west coast, the east coast monsoon in Andhra Pra desh comes only in the form of a few cyclonic spells for 3 to 4 days. As a result, the marine fishery activities are not stopped for longer stretches in any part of the area.

It is estimated that there are about 2.4 lakh marine fishermen out of whom 64,592 are active fishermen who exploit mostly in-shore area with crafts like catamarans, *navas* and *donies*. As these crafts are not suitable for intensive and extensive exploitation of off-shore and deep sea areas, it is found necessary to introduce mechanised boats and trawlers.

Need for berthing facilities :

For the introduction of mechanised boats and trawlers, establishment of fishing harbours with necessary infrastructure facilities is a must. A small fishing harbour was established in the early Plan periods at Kakinada which can provide berthing facilities only for 30 mechanised boats. The commercial inner harbour at Visakhapatnam Port Trust was for some time used to berth about 50 mechanised boats. Barring the above limited facilities at Visakhapatnam Port Trust, the Government of India sanctioned the establishment of a fishing harbour also along with it as a central sector scheme. When construction of this harbour was in progress a project for expansion of the existing fishing harbour at Kakinada and Visakhapatnam and establishment of a new fishing harbour at Nizampatnam with World Bank credit assistance was approved by Government of India for Rs. 23.80 crores. It is expected to be completed by 1983. After the completion of this project, 360 more mechanised boats are expected to be introduced in addition to about 800 mechanised boats already in operation along the coast.

The Government of India have also sanctioned establishment of a Fishing Harbour at Bhavanapadu in Srikakulam District as a centrally sponsored scheme at an estimated cost of Rs. 150 lakhs and it is expected to be completed by 1982. In the next phase, an additional fleet of 200 mechanised boats are expected to be introduced. It is also contemplated to establish two more fishing harbours-one at Krishnapatnam in Nellore District and the other at Machilipatnam in Krishna District, during the Sixth Five Year Plan facilitating the operation of 200 more mechanised boats.

As part of the programme of increasing fish production through mechanised fishing, due care is taken to meet the requirements of the traditional

fishermen. They are responsible for nearly 80 % of the present marine fish landings. Arrangements are made for providing craft and tackle to these traditional fishmermen at subsidised cost and also for fixing out-board motors to suitable craft. This will reduce their labour and at the same time improve the catch.

Institutional support .

The Andhra Pradesh Fisheries Corporation is charged with the responsibility of establishing processing plants, making proper marketing arrangements with a view to see that the producer receives proper price and the consumer gets fresh products. The Andhra Fishermen Central Cooperative Society, Kakinada has established a Shark Liver Oil Factory at Kakinada which is producing shark liver oil capsules fit for human consumption and also oil of veterinary grade.

The Government of India has given a grant of Rs.43.95 lakhs to the Andhra Pradesh Fisheries Corporation for putting up plants to produce diversified fishery products like (1) Fish Meal and (2) Fish Filletting and Minced Meat. The Andhra Pradesh Fisheries Corporation has got a large programme for establishing the above units which will make available varieties of fish products rich in protein.

These contemplated efforts for increased exploitation are expected to boost up marine fish production from the current level of 119,000 tonnes to 195,000 tonnes by the end of 1985.

Inland fisheries :

In addition to marine resources, there is a total water spread area of about 8,69,440 acres under tanks and 5,97,000 acres under reservoirs in the State. These form a rich inland fishery source. Out of this, about 5,20,000 acres of water spread area is estimated to be fit for development. A systematic, intensive stocking with quick growing varieties of fish seed like Catla, Rohu, Mrigala, Cy. Carpio, Grass Carp and Silver Carp has to be done in these waters. This, in turn, calls for creating fish seed production farms. From the existing 75 departmental farms we are in a position to produce about 17 crores of fish seed. Taking into consideration the existing water spread area and the likely water spread area to be created during the Sixth Plan, the requirements of seed is estimated at 73 crores. Thus, there is a gap of about 56 crores.

As the matter thus stands, an interesting development in Andhra Pradesh has been the setting up of 37 seed farms in private sector with the

technical assistance of the Department of Fisheries. This has been in the nature of a pioneering activity in the country. It is hoped that this trend will assist the Government in closing the gap between demand and supply of fish seed in the state. However, during the Sixth Five Year Plan, it is proposed to establish large commercial seed farms both in the Corporation Sector and in the Cooperative Sector to produce seed for which there is an ever increasing demand.

The Government are also trying to encourage small farmers to establish small manageable farms where fish can be grown on scientific lines. The present method of fish production is more or less of wild nature yielding about 600 kgs per hectare. When tanks exclusively meant for fish production are constructed, fish culture on scientific lines can be taken up and the level of production can be raised from 5 to 8 tonnes per hectare. Several large agriculturists have already taken to conversion of their paddy fields into fish ponds on realising high returns at low investment and less labour problems.

Taking into consideration the trend of development on inland fishery resources, it is expected that the present level of production of 132,000 tonnes will be raised to 260,000 tonnes by 1985.

Brackish water and aqua culture :

Apart from the above cited two major types of water sources, fish culture in brackish water areas is gaining importance. India has an estimated 7 million hectares of brackish water area which is a potential source for development of aqua culture. These are, however, being exploited mostly by traditional fishermen for their natural fishery.

There is an increasing demand for prawn in foreign countries. Also, there is a possibility of depletion of these varieties due to over exploitation from the sea. Scientists have focussed their attention on brackish waters as a potential source for prawn culture. Technology of brackish water culture has been developed to carry from the "Lab to Land" stage. A general awareness is created among the fishermen and the enterprenuers to take up commercial culture of prawn and fish in brackish water areas.

Andhra Pradesh is one of the maritime States having rich brackish water resources. A preliminary survey conducted by the Department of Fisheries identified about 64,000 hectares of brackish water area along the coastal districts. Out of this about 17,000 hectares is found suitable for conversion into brackish water farms.

A fetching industry :

It is estimated that through proper management, two tonnes of fish and half tonne of prawn can be realised from one hectare of brackish water area, the value of which will be about Rs.20,000/- The Government of Andhra Pradesh have recently taken a decision to develop these areas through individual Cooperative Societies and individuals. A project profile at a cost of about 43 crores has been prepared for developing the suitable brackish water sources in the State. When these areas are developed, it will produce 17,956 tonnes of fish and 4572 tonnes of prawns.

The fish industry can thus contribute nutritious food and help the community earn considerable foreign exchange.

Discussion

The following salient points were discussed :

1. The possibility of growing fish alongside paddy in fields must be considered seriously.
2. Though inland fish is not in surplus, there is a surplus of marine fish. The surplus can be utilised for preparation of fish meal.
3. Fishermen must be encouraged not to sell all the catch but consume part of it and enrich their diet.

The role of Agro-Industries, Agricultural Marketing and Related Activities in Employment Generation

Dr. Waheeduddin Khan
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Administrative Staff College of India, Hyderabad.

The growth of agro - industries and supporting activities connected with the storage and marketing of raw and processed agricultural commodities is directly associated with the trend behaviour of a large number of economic variables. These variables determine the rate and pattern of growth of agro industries and storage and marketing services. Two major, broadly defined categories of these variables are : a stable and continuous rise in consumer income and improvements in the levels of productivity of land labour and capital in the agricultural sector. They represent both the necessary and sufficient conditions for the development of agro-industries. The growth of agro-industries and agricultural marketing systems gains momentum with a rapid improvement of income and productivity levels brought about by technological changes in agricultural and industrial production systems. This process provides a further impetus to the agricultural production system and also leads to the expansion of employment opportunities in the non-agricultural segments of the rural economy.

Organisational and structural aspects of agriculture

In any discussion of the sequence of the development of off-farm activities related to agricultural production, organisational and structural features of farm-level activities are important. A comparison of the distinctive features of the farm-level activities in different types of economies, at different levels of economic development illustrates this point. In the less developed economies where agricultural sector in particular is backward, organization of farm-level activities is essentially subsistence-oriented. Food and other agricultural commodities are produced by the farm families for own consump-

tion; the amount of surplus food, etc., available with such families is negligible and, therefore, their exchange transactions are few and small in volume. In relatively more developed agricultural economies, producers of agricultural commodities have market-orientation; their surpluses are large and, therefore, the volume of their transactions is large. It is in such situations that agro-industries, particularly food processing industries, expand. Also the agricultural marketing system grows to integrate the activities of the producers and consumers.

Intervening stages and forms of consumption

The underdeveloped state of the agricultural sector can be distinguished from the developed state along two dimensions : Firstly, there are fewer intervening stages between the producers and the consumers in the former case; secondly, there is none or little difference in the primary form of the commodity and the form in which it is finally consumed. This is not only true of cereals and other food items, but also of other commodities to some extent. In the first case, it is the household's own effort which brings to it the product which it consumes; it is again its own effort which is put in at the processing stage, and finally, once again, for storage, the effort is contributed by the household itself. In the other example let the producer be A, the primary buyer B; the product is processed by C, stored and sold by D; and the consumer is altogether a different alphabet. In the second example which describes the extended chain of transactions, income and employment of different levels are being generated at different stages and accrue to different individuals.

Assume that our two examples refer to two sets of fishermen; the first set catches, salts and stores its own fish for consumption; the second is integrated with the rest of the economy. Let us ignore for the moment the possibilities of monopolistic and exploitative behaviour of some of the actors involved. It would then be clear that rising consumer incomes in the economy and increased productivity contribute to the process of development of agro industries and agricultural marketing systems. In addition, larger employment and higher income opportunities are provided.

The Indian scene

In the Indian context, there are many agricultural products which have a large employment potential in the processing, marketing and storage activities. To mention only the more important ones: wheat, paddy and maize among cereals, groundnut, mustard and sesame among edible oilseeds; pulses, sugarcane; milk, fish and poultry; and a whole range of fruits and vegetables.

This list leaves out crops such as tobacco, tea, jute and cotton where the processing activity is already well developed. To be able to appreciate the problems and prospects of realising increased income and employment opportunities through agro processing, warehousing and marketing in India, it is necessary to understand the socio-economic scenario in which their role is being discussed. There are certain aspects which need to be highlighted : these aspects concern the supply side, the demand side and the organisation side. Together, they define the state of affairs, the potential in the situation, and the range of options.

Sluggish agricultural growth :

Taking first the supply side, one notices that the rate of growth of the agricultural sector has been, on the whole, most sluggish. Agricultural production increased at the rate of 3.3 per cent per year during the '50s; thereafter, it slowed down to around 2.3 per cent. The long-run annual rate of growth of the economy has been around 3.5 per cent. Thus, the share of agricultural output in the national income declined over the past 30 years. Agricultural production could not increase at a more respectable rate because of well-known structural and technological problems. About 79 per cent of the operational holdings, accounting for 31 per cent of the total cultivated area, is held in holdings of less than 3 ha. Another 31 per cent of the total cultivated area, is operated by only 4 per cent cultivators in holdings of more than 10 ha. These two classes of cultivators represent the extreme ends of the spectrum. The former have no surpluses to offer on a stable, continuous basis. Their output levels are highly variable from year to year because of the weather factor. The technology which can impart greater stability and ensure larger output is either not available, or is beyond their means.

Circumscribed demand :

On the demand side, the scenario is no better. Information regarding per capita income is not available; However data on consumption expenditure for many time points is available. From this, it is seen that per capita consumption expenditure has been increasing at an annual rate of between 1.5 and 1.7 per cent. According to the NSS data for October 1973-June 1974, the average monthly per capita consumption expenditure level in the rural sector was Rs. 53.01, and in the urban sector Rs. 70.77. These are average levels which disguise very considerably the wide disparities in consumption expenditure levels of the different income classes. For example, according to the V Five Year Plan draft, 30 per cent of the rural population had a per capita, per month consumption expenditure level of just Rs. 22.90 (in 1970-71 prices) in 1973-74. This shows that the demand is severely circumscribed, in

quantity and quality, for goods and services. Unless the levels of income improve and pattern of income distribution become less skewed, demand in general will remain low.

Thus, neither the supply side nor the demand side has shown the dynamism usually associated with the expansion of employment opportunities in the agro-processing, storage and marketing systems.

On the organisation side, agro-processing and the related activities are marked by a wide diversity of technologies and disparate trends in their development. Along with traditional processing and storage technologies, one comes across the most advanced technologies in case of most agricultural products. Hand-pounding of paddy and manual pressing of oil-bearing materials coexist with integrated rice-mills and solvent extraction plants. Private financial profitability margins – ensured and enlarged by credit, licensing and pricing policies of the State – make the modern processing technologies more attractive. The small increments from year to year in the surplus coming up for processing are picked up by the modern units where only a small proportion of the value-added goes by way of the labours' share.

Employment Generation

To what extent can additional employment capacities be created in the agro-processing, transportation, warehousing and marketing systems ? This depends on the rates at which the supply of and demand for agricultural commodities increase. It also depends on the choice of processing, storage and handling technologies. The private optimum choice will differ from the social optimum for obvious reasons. Employment implications of technology choice do not concern private decision-makers. Where the technological choice lead to larger direct employment creation, it would be so by accident rather than by design; and will be coincidental to private profit maximization. The efficiency of a technology is capable of being defined more diversely in public or social choice of technology; employment generation is one of the possible objectives to be maximised.

One of the interesting policy issues is choosing an agroprocessing technology when: (a) the overall rate of growth of the economy is slow; (b) rate of growth of agricultural output is slow; (c) because of the scarcity of certain important agricultural commodities the marginal value of increments in supply is very high; and (d) the incidence of under and unemployment in the rural sector is quite marked.

Decision on processing technology

These factors influence the choice of technology in different directions. The marginal unit of output in an overall scarcity situation will be of high social value. The processing technology chosen should therefore be efficient in the sense that it entails minimum wastage; the inability of the economy, due to the slow rate of growth of output, to provide expanding opportunities of employment would indicate the choice of a processing technology which would generate a larger number of jobs per unit of output processed. This is a veritable dilemma. However, at closer examination at the level of individual agricultural commodities, the problem of technology choice becomes less vexatious; and reasonable objective criteria of selection can be identified. All agricultural commodities are not scarce in the economy to the same extent; therefore, the values attached at the margin to increments in their supply will differ from one commodity to another. Also, the trends in the growth rates of different commodities are manifestly different; for example, while the rates of growth of pulses, which are relatively more scarce, are very slow those of paddy, wheat and maize etc., are comparatively better. Through such a process of analysis, the severity of constraints on the choice of processing technology can be examined in detail for all important agricultural products.

One of the serious difficulties in recommending technologies arises on account of the lack of necessary detailed information. For example, in their recent article on oilseeds, Chandrasekaran and Achaya draw pointed attention to the difficulties in putting together necessary data for a comparison of the different technologies for the oilseeds crushing sector. Through extensive and tedious efforts they were able to generate data only for certain years. Their fragmentary data are nonetheless interesting for our purpose of illustrating the approach to technology choices in the agroprocessing activities. The data are presented in Tables 1 and 2 below :

TABLE 1

Proportions of Total Oil-Bearing Materials Crushed in Traditional Ghanis*

Oil-bearing material	Crushed by Ghanis (per cent)	Oil-bearing material	Crushed by Ghanis (per cent)
Groundnut	20	Cottonseed	Nil
Rape/mustard seed	37	Copra	20
Sesame seed	83	Safflower seed	94
Linseed	30	Niger seed	67
Castor seed	Not known	Sunflower seed	Nil

* All figures, except for safflower, niger and sunflower seeds, from 'Report of the Oilseeds Crushing Enquiry Committee (1956)", quoted in Oilseeds in India (156-57)', Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi, November 1957, p. xv.

* S. Chandrasekaran and K. T. Achaya, 'Profile of Indian vegetable Oil Industry I - Production System'. Economic & Political Weekly, Feb. 23, 1980.

TABLE 2

Oil Recovered Through Crushing in Traditional Ghanis and in all Other oil Mills

(Percentages)

Oil-bearing material	Oil [1] content	Oil recovered in		Oil left in cake in	
		Ghanis	Mills	Ghanis	Mills
Groundnut kernel	43	35	40	11.6	5.0
Rape/mustard seed	40	30	35	14.2	8.0
Sesame seed	47	37	42	15.2	9.0
Linseed	40	30	35	14.2	7.3
Castorseed	45	35	40	9.7	7.9
Cottonseed	21	Not practised	15	—	7.0
Copra	63.67	58	64	11.6	6.6
Safflower seed	30	21	24	11.4	7.7
Niger seed	40	30	35	14.3	7.7
Sunflower seed	40	Not practised	35	—	7.9

Note : 1 Calculated from oil recoveries and oil left in cake : only for copra does this yield different values for oil content when using ghani and mill data.

Source : S. Chandrasekaran and K. T. Achaya, op. cit.

Table 1 shows that in the late '50s, almost 94 per cent of safflower seed, 83 per cent of sesame seed and 67 per cent of niger seed were crushed in traditional ghanis. Even as early as the late '50s, not more than 20 per cent of copra and groundnut were available to this traditional sector. In other words, inroads made into the oil crushing industries by non-traditional or modern technologies were already quite phenomenal in respect of some important oil-bearing materials. The trend might have strengthened since the years for which the data are presented in the Table; unfortunately, no confirmation is possible because more recent data are not available. It is anybody's guess as to how much employment loss was entailed in the diversion of oilseeds from the modern crushing sectors.

Efficiency Vs. Employment Potential :

In Table 2 a very interesting comparative picture of crushing efficiency of the ghani and mill technologies is presented. The oil recovery efficiency of the ghani is lower than that of the mill, in most cases, by only about 5 per cent; and the oil left in the cake in the ghani technology is, in most cases, around 6.5 per cent more than that left in the cake in the mill technology. The point can then be made that the oil recovery efficiency of the two technologies should be compared with their respective employment creation potential. Two additional cosiderations here would be the marginal value of the incremental final product, and that of the additional unit of employment, both expressed in relative social importance. This comparison will provide a socially sensible trade-off or criterion for choosing between the two.

Thus, taking the case of groundnut crushing as an example, if for a 5 per cent lesser output of oil per unit of seed as crushed by the ghani, a certain number of additional jobs are created than in the mill sector, a choice between the two can be made on the basis of weights (measure of importance) given to an additional quantity of oil and an additional amount of employment. An integrated large groundnut oil mill is by all descriptions much more efficient than the traditional ghani from the point of production efficiency; but the extra amount of oil, it must be realised, is being obtained at the loss of a certain number of jobs.

To give a further illustration of the approach; consider the total availability of rice in the economy; it is not in short supply such that a slightly higher percentage of 'broken' rice due to less efficient processing is going to make a difference to the availability of good rice for consumption. In other words inefficiency of the processing technology can be 'afforded' if required in order to generate more employment. Therefore, out of the additional paddy

production in the years to come, a larger proportion may be reserved for the less sophisticated paddy processing technologies, including hand-pounding, if more employment per unit of processed paddy is to be created.

This kind of analysis for all the major agro-processing technologies would be necessary to decide on a technology policy for promoting employment in the non-farm sector of the rural economy. The same argument also holds good in the case of technologies for warehousing and handling agricultural products.

One may close the argument on a rather unsatisfactory, if not pessimistic note, that the role of agro-industries and allied systems in employment generation will not be fully realised in the Indian context unless socially optimal policies, having a bearing on technology choices are worked out.

Discussion

The following salient points were discussed :

1. Local industries based on agricultural output would help the farmer. But most agrobased industries are seasonal. Suitable planning must be done to ensure that they are more viable and function round the year.

2. Decision on marketing and pricing policy must not be taken in isolation but after a consideration of the related socioeconomic factors.

Concluding Session

The presentations of the participants and the discussion generated by them revealed that as far as the capabilities for food production were concerned, we do possess adequate expertise and experience for raising the foodgrain output. The technology required for genetic manipulation and inbreeding desirable nutritional characteristics into the different plants is also available. In fact, there has been considerable progress in the field. But there is yet much scope to further refine these strategies of cropping improvement through efficient management and manipulation to fulfil the nutritional targets.

There also appears to be an urgent need for several other inputs and infrastructure to ensure more organised market economy, pricing policy, transport, preservation facilities etc. Specific attention is to be given to efforts for generating viable employment opportunities in the economy based on agro-industries. This would go a long way in supplementing the income of the unemployed and under-employed rural population and thereby increasing their purchasing power.

The workshop conceded that despite availability of technology required for making us self-sufficient in food and though we are nearly in a position to meet the nutritional goals, a wide gap does exist. A basic bottleneck is that these benfits are not reaching the ultimate target, namely, the farmer, due to flaws in implementation at various levels. The workshop urged that more attention be devoted to this aspect

Workshop on

Nutrition Education - Communication Materials, Media and Agencies

July 23 - 24, 1980

Wednesday, July 23, 1980

INAUGURAL SESSION

9.30 a. m.	Welcome	:	**Dr. (Smt) P. Pushpamma** Dean College of Home Science Andhra Pradesh Agricultural University, Hyderabad
			Dr. V. Nagarajan Asst. Director-General Indian Council of Agri- cultural Research New Delhi
			Mr. J. F. Coloane Asst. Programme Officer UNICEF, New Delhi
			Dr. M. Mohan Ram Asst. Director National Institute of Nutrition, Hyderabad
	Inaugural Address	:	**Dr. C. Prasad** Dy. Director-General (Edn) Indian Council of Agri- cultural Research New Delhi
	Presidential Address	:	**Dr. E. N. Katkar** Resident Programme Officer UNICEF, Hyderabad
	Vote of Thanks	:	**Dr. (Mrs.) P. Geervani** Professor and Head (F & N) College of Home Science. Hyderabad

Wednesday. July 23, 1980

SESSION – I

	Chairman	:	**Dr. S. G. Srikantia** Former Director National Institute of Nutrition, Hyderabad
	Rapporteur	:	**Dr. (Mrs) P. Geervani** Prof. & Head (F & N) College of Home Science Andhra Pradesh Agricultural University, Hyderabad
11.15 a. m.	Current status of nutrition education and agencies involved	:	**Dr. (Mrs) Tara Gopaldas** Professor and Head Foods & Nutr. Department M.S. University of Boarda Baroda
12.00 noon	Social and Cultural Factors	:	**Dr. (Mrs) K. Chittemma Rao** Project officer Operations Research Project College of Home Science Andhra Pradesh Agricultural University, Hyderabad

SESSION – II

	Chairman	:	**Dr. L. D. Swindale** Director ICRISAT, Hyderabad
	Rapporteur	:	Dr. (Mrs) K. Chittemma Rao Project officer, Operations Res. Proj. College of Home Science Andhra Pradesh Agricultural University, Hyderabad
2.00 p. m.	Role of Agricultural Extension in Nutrition Education	:	**Dr. G. Rangaswami** Adviser (Agri) Planning Commission New Delhi
2.45 p. m.	Role of Regional Home Economists in Nutrition Education	:	**Miss. Padmasini Asuri** Regl. Home Economist Bangalore
3.45 p. m.	Communication Methods: in Nutrition		**Miss Indira Gopalan** Asst. Research Officer National Institute of Nutrition, Hyderabad

Thursday, July 24, 1980

SESSION - III

	Chairman	:	**Mr. J. F. Coloane** Asst. Programme Officer UNICEF, New Delhi
	Rapporteur	:	**Mrs. Hema Rao** Asst. Prof. (Extension) College of Home Science Andhra Pradesh Agricultural University, Hyderabad
9.30 a. m.	Mass Media Techniques	:	**Mr. V. Dhananjaya Rao** Officer-in-charge Agri. Inf. & Commn. Centre College of Agriculture, Andhra Pradesh Agricultural University, Hyderabad
10.15 a. m.	Development and Demonstration of Education aids for nutrition	:	**Mrs Parvati Rau** Field officer National Institute of Nutrition, Hyderabad
11.00 a. m.	Role of Home Scientists in Nutrition Extension/Education	:	**Dr. (Mrs) S. Bajaj** Professor and Head Foods & Nutr. Department Punjab Agrl. University Ludhiana

Thursday, July 24, 1980

SESSION - IV

	Chairperson	:	**Dr. (Mrs) P. Pushpamma** Dean College of Home Science Andhra Pradesh Agricultural University, Hyderabad
	Rapporteur	:	**Mrs. Parvathi Rau** Field officer, National Institute of Nutrition, Hyderabad
12-00 noon	Nutrition Education through different community level workers	:	**Dr. M. C. Swaminathan** Dy. Director, National Institute of Nutrition, Hyderabad
12-45 p. m.	Role of Voluntary Agencies in Nutrition Education	:	**Ms Ravina Chadha** Programme Officer (Nutritionist) CARE India New Delhi

2-45 p. m. CONCLUDING SESSION

Inaugural Session

Wednesday, July 23, 1980

Welcome Address

Dr. (Mrs) P. Pushpamma
Dean
College of Home Science
A. P. Agricultural University, Hyderabad.

I deem it a great privilege to welcome you all to the workshop on Nutrition Education on behalf of Andhra Pradesh Agricultural University. This workshop organised by the National Institute of Nutrition and ICAR in collaboration with UNICEF is second in the series following the workshop held in the National Institute of Nutrition on 'Strategies in Agriculture Sector for Nutritional Goals'.

It is a pleasure to welcome Dr. C. Prasad, Deputy Director-General (Education) ICAR to the College of Home Science as the Chief Guest. Even before taking over the responsibility of the education wing, he has been very closely associated with Home Science Colleges especially regarding nutrition education through Krishi Vigyan Kendras. The effort he has made to be present here today and inaugurate the workshop inspite of his heavy schedule assures his full support from ICAR in strengthening the extension programmes in Home Science Colleges.

I would like to take this opportunity to welcome Dr. V. Nagarajan, Asst. Director-General (Nutrition), ICAR. It is well recognised that his untiring efforts supplemented by the dynamism of Mr. J. F. Coloane, his counterpart from UNICEF provided the nourishment for rapid growth and development of HEFN Programme in Agricultural Universities. We are fortunate to have with us today Mr. J. F. Coloane and Dr. E. N. Katkar from UNICEF who recognize the role of Home Science Colleges in training and extension of nutrition education.

I would like to extend our hearty welcome to the Director and Staff of the National Institute of Nutrition and participants of the workshop who have come from various agricultural universities.

This workshop symbolises the commitment of HEFN Programmes to nutrition education not only in the colleges but also to the public. The Home Science faculties in Agricultural Universities, like other faculties, are responsible not only for teaching but also for research and extension (including training of extension functionaries). For this reason Home Science Colleges will be the best centres for nutrition training and extension. Realizing these three-dimensional responsibilities, the Home Science Colleges in Agricultural Universities are re-organizing their curricula, staffing pattern and other facilities so that they can play their role effectively. The assistance under HEFN programme for the departments of Foods and Nutrition of Home Science Colleges will be of great value to these departments so that they can act as regional centres for disseminating the nutrition knowledge derived from national and international institutions.

This workshop is also a land-mark as the first collaborative venture of the National Institute of Nutrition and College of Home Science and I hope this will be the beginning of a long, successful association.

I finally wish a great success to the workshop and hope it will provide guidelines for effective nutrition education as a result of the presentations of the eminent and experienced nutrition educationists participating in this workshop.

Mr. J. F. Coloane, Asst. Programme Officer, UNICEF, New Delhi, welcoming the participants of the Workshop on Nutrition Education

Extracts from The Welcome Speeches Delivered by Representatives of ICAR, UNICEF and NIN

Speaking on behalf of ICAR, Dr.V. Nagarajan stressed that apparent communication gap existing between the health extension and agricultural extension workers should be bridged by effective interchange of information.

Mr. J. F. Coloane, Asst. Programme Officer, UNICEF spoke of the extension work in rural areas and of the involvement of UNICEF in programmes such as the Applied Nutrition Programme.

Dr. M. Mohan Ram, Assistant Director, NIN, welcoming the gathering on behalf of the Institute, said that nutrition is a multidisciplinary subject and the nutrition component ought to be built into all faculties related to food, agriculture, medical, veterinary and social sciences.

Inaugural Address

Dr. C. Prasad
Deputy Director General (Education)
Indian Council of Agricultural Research, New Delhi.

Dr. Katkar,, Dr. Pushpamma, Mr. Coloane,
Dr. Mohan Ram, Participants, and Friends,

I consider this a rare privilege and a unique opportunity to be associated with this workshop on Nutrition Education which has been jointly sponsored and organised by NIN, ICAR and UNICEF. I am equally delighted to learn that this workshop is intended to benefit the Co-ordinators and Assistant Professors who are responsible for and actively associated with the Higher Education in Food and Nutrition programmes launched in the Agricultural Universities by the ICAR and UNICEF in partnership. The arena of Teachers' education, specially in the professional fields, has been relatively a forgotten subject, leaving subject matter and pedagogy far apart. I am happy that the National Institute of Nutrition is alive to this vital area and this has been amply exhibited by the way this course on human nutrition has been scientifically planed and humanely organised integrating both the subject matters and pedagogy in their proper mix. I compliment the authorities and the staff of this Institute for building a lofty tradition of Teachers' education in the field of foods and nutrition.

Nutrition, as you better know, is basic to life and *education,* for sure, opens up the new vista of life giving it new experiences, richer meaning and making the life creative, purposeful and productive. Nutrition education, thus, represents, as a matter of fact, double lives put in one soul. We all are common customers of this precious commodity, but it has been so uncommon to give realism to it. Perhaps, nutrition and education could not be wedded together and, therefore, it has rightly become a concern of the *Pandits*, the scientists and educators of this valued discipline. I wish, it should be equally the priority concern of the planners and administrators of the country.

Education and training in any field - and more so in professional ones is one of the most crucial inputs for accelerated productivity and production. The organisation for Economic Cooperation and Development calls it as "Intellectual Investment". Talking of the fields of agriculture to which

food and nutrition have symbiotic relationship, the countries which have realized the demand for education and training early have advanced agriculturally and have harnessed the agricultural production potentials in their best interests. The Republic of Korea and Japan have at least one College or Faculty of Agriculture for every 1200 square miles, and the number of vocational schools is about four times the number of the Colleges and Faculties[2]. It could be seen, thus, that the density of agricultural institutions in these countries reflects the emphasis given to agricultural education and training, and hence they have obviously scored over other countries of the Asian Region in agricultural sector. This trend, for foods and nutrition, if not a total reality, at least is a pointer towards enhanced future requirements for educational and training infrastructure in the country.

As I could see, a basic drawback with our education and, in our educators for that matter, is that in education in general and in the professional education in particular, we have been more or less behaving as blind men: to one the elephant is like a wall and to another like a fan or a tree depending upon the portion of the elephant's body they happened to touch and perceive. In other words, some educators are committed to higher education, some to advanced research, some to middle or intermediate level education, and still some to the school or community/village level education. This is unfortunate, indeed. What a progressive education requires is the conception of education as a continuum starting from the community education (non-formal education) to school, middle/intermediate level education and then to the higher level education. Education at all these levels must be functionally linked to the extent possible, because they are not mutually exclusive and, hence, they should meaningfully interact, influencing and benefitting the education and training at each level.[3] Do we visualize this coherent functionality in the field of nutrition education or for that matter in any other professional fields?

I am indeed happy to share that in the field of agricultural education, we have made a dent both in vertical integration:non-formal education to university education, and horizontal integration:in teaching, research and extension education. This is why, the country is proud of the performance of agricultural sector–a rare feat indeed if one compares the historically slow pace of agricultural growth both in developed and developing countries. Nevertheless the integrated functioning of teaching, research and extension education has not been an easy task, and, in fact we have a long way to go in streamlining it both at organisational, administrative and personal levels in order to exploit its full potential. This subject of integrated working is, no doubt, contagious and it must prevail and permeate in all systems of education.

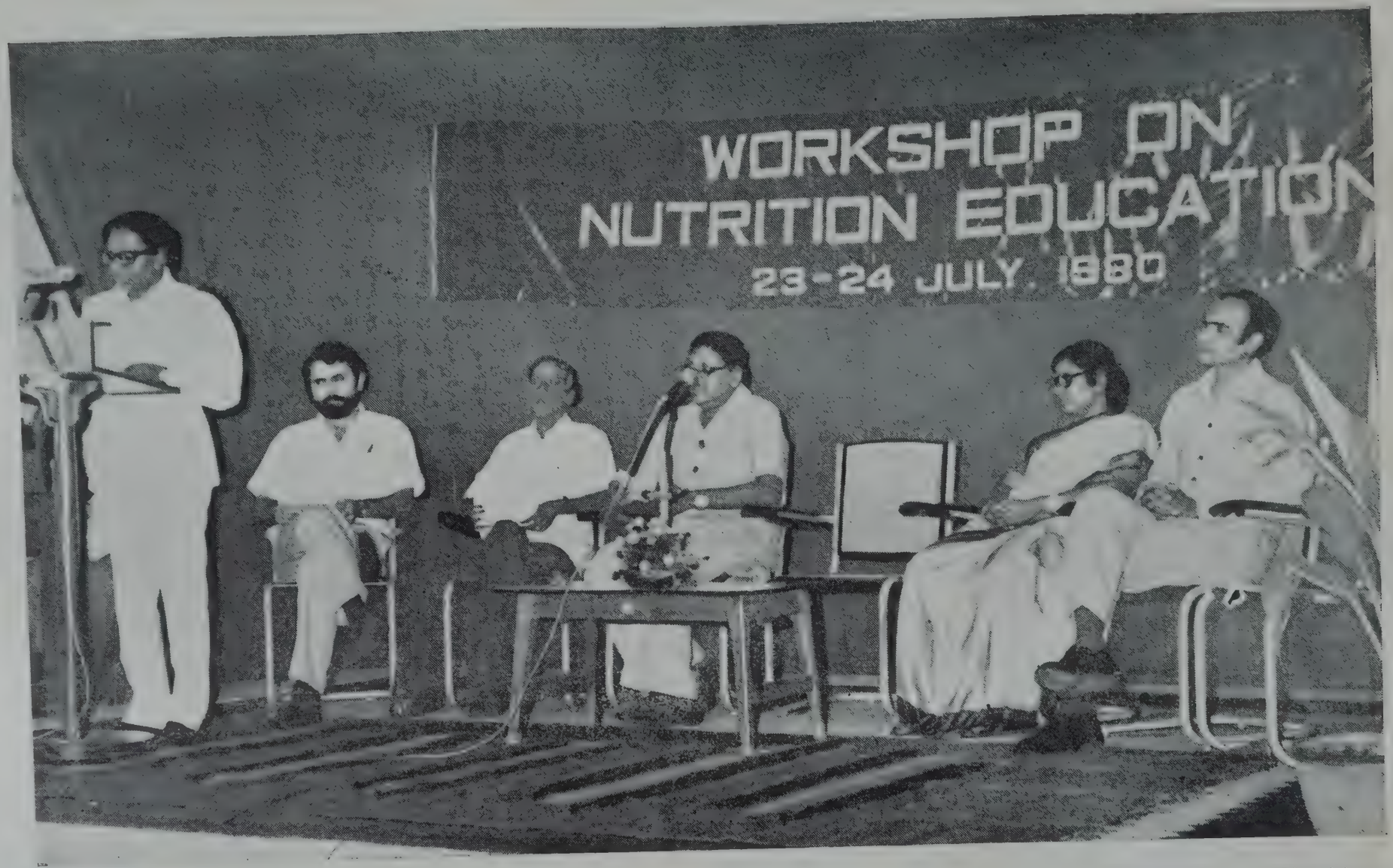
In the professional persuits like nutrition education and such others, integration of education, research, extension, and training functions is not only essential but imperative.

In Agricultural Universities, we have focused on three main functions as pillars of agricultural development system-instruction, research and extension education. In my view, training (both short and long term), so far an integral part of Extension Education, is emerging as a potential area for vocational education as well as dissemination of the benefits of modern science and technologies in the community at large. This subject has not received as much importance and attention which it deserves. It is hightime that in our Universities and Institutions, training is recognised as a fourth important function together with teaching, research and extension education. The four pillars, thus, will give stronger support to our agricultural development system. A massive investment is required for strengthening our training infrastructures, and the area of foods and nutrition in this regard is no exception.

Nutrition education is quite an inclusive and complex subject; This complexity stems from two main sources: first, the nature of the subject itself which touches a wide spectrum of coverage — before the birth of a child to the death of individual; from the production of foodgrains to its conservation and consumption; and second, the food being an every-day phenomenon people don't seem to value what is readily accessible to them; this becomes a routine affair. To these, factors like production and distribution systems; mass illiteracy specially in rural areas; tradition bound general educational system; half-hearted support to nutrition education programmes; relatively rigid food habits; under-nutrition; protein-calorie malnutrition; and poor economic status, further aggravate the situation. They pose a really threatening challenge which has to be tackled by individual as well as collective and cooperative ventures.

The country could have been self-sufficient in food long back, if only our food habits were consistent to the balanced dietary requirements — proportionate use of cereals, pulses, fruits, vegetables, animal products etc. But, as you know, we eat vegetables or meat to eat more rice or bread; rural folks would not care to eat vegetables which are locally and cheaply available; things are cooked and fried to the point of destroying their nutritional values and so on.

The country is by and large, self-sufficient in food production, and in fact, we are capable of doubling the production if the system for the transfer



Dr C. Prasad, Dy. Director General (Education), ICAR, delivering the Inaugural address at the Workshop on "Nutrition Education, Communication Materials, Media and Agencies". Also seen on the dais are (from left to right) Mr. J. F. Coloane, Dr. V. Nagarajan, Dr. E. N. Katkar, Dr. (Mrs.) P. Pushpamma and Dr. M. Mohan Ram.

of technology could match the present advancement in agricultural and allied sciences. But what about the distribution system? What about the purchasing capacity of the rural poor? What nutrition education can be offered to them? The country must provide jobs to millions and raise their production and, thus, purchasing capacity. No doubt, this is a formidable task, but there is no short-cut. The population growth must be arrested side by side within a reasonable time limit.

Dr. M. S. Swaminathan postulates that genetic improvement of nutritive quality of basic staples is another venue of providing better nutrition at no extra cost. Chemical fortification with limiting aminoacids, which used to be the major approach advocated ten years ago, has given way now to attempts to improve genetically the aminoacid balance and nutritive quality of crops like maize, jowar, barley, potato, wheat and rice.[4] Another area of concern should be the post-harvest technologies. Almost 30% losses occur, as is reported, at various post-harvest handling stages to both physiological and microbial spoilage. Besides quantitative losses, qualitative losses are no less. Several of the insects carry pathogens which are hazardous to life.

Realization of nutrition education has come rather late. Virtually upto the Third Five Year Plan, no effort was made in this direction. It was in the Fourth Five Year Plan, as you know, that the integrated nutrition programme was launched and since then it has been gaining momentum. Programmes such as meals for pre-school children, Applied Nutrition Programme (ANP), Family and Child Welfare, School Meals, Composite Family and Child Nutrition Project etc., have been started and have met with some success. To accomplish this task, like its multi-dimensional character, many institutions/agencies have been involved from health sector, agricultural sector, centres of excellence, educational institutions, voluntary organisations and international agencies like CARE, UNICEF, WHO etc. Since human nutrition is the question of life and death, without exaggeration all systems starting from families to international bodies must contribute directly or indirectly on this subject, depending upon their areas of jurisdiction and concern. Such awareness must grow and, as a matter of fact, it should be brought to the point of acceptance and adoption.

The task being so challenging, it would be strategic to ask questions such as: What are our immediate objectives in terms of target groups ? what are our long-term goals in this regard ? It is relatively easier to approach urban centres and enlightened and educated individuals with the package of improved nutritional practices. But what is the lot of 80% of the rural population who are not only poor, but ignorant and illiterate ?

This implies that our village extension work in nutrition must be further enlarged and activated, school curriculum should have nutrition in its rudimentary form—the experience of nutrition education in primary schools in Tamil Nadu of Sri Avinashilingam Home Science College for Women, Coimbatore[5] might be a guideline in this context; and the training programmes which are directed towards rural audience must have nutrition education as one of the thrusts. The approach and methodology being followed in Krishi Vigyan Kendra (Farm Science Centres) of the ICAR might be helpful in this regard.[6] These rural based first-line vocational training institutions are proposed to be further strengthened in the field of nutrition with additional inputs from UNICEF and DANIDA. Another thrust which the ICAR is making is the establishment of Home Science Colleges in Agricultural Universities with rural oriented curriculum (they should better be called as Rural Home Science Colleges). A lot of importance is being attached to technologically oriented education like food technology, meat technology, post-harvest technology, etc., by the ICAR in the Sixth Five Year Plan.

Effective Communications Systems, various media and agencies and relevant materials are *sine qua non* for rapid dissemination of nutrition innovations. I am extremely happy that this workshop has planned to deliberate on this aspect. In this connection I have some basic issues to raise : Who are the communicators and how best are they committed to the objectives of nutrition education ? In my estimate, we have crisis of committed people and hence many of our well intentioned projects crumble at the performance evel. And when the projects relate to rural areas, they suffer much more. The how of these issues will be worth examining.

How can the commitment, a sense of service and sacrifice be brought about ? Could not this be a subject of immediate concern for the nation? This is, no doubt, a tough subject and, therefore, we evade it : we talk of more material things: communication aids, mass media, satellite communication, and the like, ignoring the human body and mind. I have no doubt that the communication which does not come from self-conviction and within cannot cut much ice. Human willingness and sensitivity to service should serve as a basic launching pad to material mechanics and aids of communication. For such training, there cannot be a formal curriculum-this has to come about by setting good example by elders, educators, administrators, planners and politicians alike in all walks of life. We have examples of institutions which are based on the foundations of devotion, sacrifice and service. To mention a few : Gokhale Society of Education (Maharashtra), Kasturba Gandhi National Memorial Trust (M. P), Ramakrishna Mission (W.B), Mitraniketa (Kerala),

A view of the audience at the Inaugural Session of the Workshop on Nutrition Education

Seva Bharati (W.B)., etc., are doing excellent work in the service of mankind. Some association to and involvement in such institutional activities will amount to the training I am talking about. Such institutions should be utilised to human resources development for moral development.

Dr. M.S. Swaminathan, in search of developing people devoted to rural growth, has lately evolved a scheme called "National Rural Resource Corps" through which he plans to utilize unemployed graduates–to start with the technical ones, with nominal honorarium for serving rural areas for 2–3 years. Out of this effort, he feels, even if 25 per cent of the so employed graduates could change their destiny to serve the rural poor, the scheme will be considered successful.

Talking about extension / communication strategies, one has to be indigenous and original to a great extent – overhead projectors and such other gadgets alone cannot help. For instance, one would like to go and see the work of the Krishi Vigyan Kendra of the Gokhale Education Society at Kosbad Hill, Thane Distt (Maharashtra): (1) Nutrition Gardens are being popularised in tribal rural community where there is scarcity of water the family members are trained to wash their hands/legs, take bath or clean utensils close to the newly transplanted fruit plants. If ten such useful plants are stabilized around each home, they will be a permanent source of nutrition; (2) their Balwadi is a living museum for the children of two and a half to five years–there are poultry birds, a fish pond, a nutrition garden, and all the natural environment to inspire and fire their imagination and (3) the tribal women are working ladies and in many cases their evening meals depend on the earning of the day. Under the circumstances, they are not available for training in the Krishi Vigyan Kendra. But they have the arrangement to collect their children for Balwadi by their staff in the morning and the mothers are required to collect them after the school hours. When the mothers come, they are seated in a small hut and they are shown and demonstrated how to cook without losing nutrients, what a balanced diet means in their cases and what it means when they germinate the gram or moong and eat them ? Thus, they get 30-45 minutes training daily before they collect their children and go home. Our extension agents have to think of such different devices for different settings.

Well, the commitment of the individual workers/communicators is only one side of the coin. What is our commitment or say, the commitment of the Government for such communicators who are devoted to and have made contributions in the rural upliftment ? You may find several Village Level Workers (VLWs)- the real communicators in the villages, serving in the rural

reas for over the last 20 years without much scope for promotion and more than that, some of them are serving in a temporary capacity. One could easily visualize its adverse impact on their morale and working. This is only one example. Besides, one knows what it means to work in the rural areas – no proper accommodation, no good schools for children, no health centres, no adequate transportation and communication, and so on. And adding salt to injury is the fact that the rural based workers/officers are not as privileged as the urban/city based workers/officers in term of pay, allowances and such other benefits. And yet, we expect to make rapid strides in modernizing the rural villages. In fact, our *Personnel policy* must change in favour of rural workers as a long-term device for rural regeneration. This is long overdue.

At the end, I must express my gratefulness to the Director of the National Institute of Nutrition and the organisers of this workshop for providing me this unique opportunity to interact with our nutrition educators. I am hopeful that your deliberations will be useful not only in terms of understanding the nutrition problems and charting out the appropriate strategies, but they must result in action and acceptance. With these words, I take the privilege of inaugurating this Workshop on Nutrition Education–Communication materials, media and agencies.

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Presidential Address

Dr. E. N. Katkar
Resident Programme Officer, UNICEF, Hyderabad.

In the earlier days, nutrition was considered to be synonymous with 'feeding' people and was looked upon more as an act of charity; and all charitable activities belonged to religion. It was in 1926 that Toynbee said that we should make charity 'scientific'. All of us gathered here today are trying to apply the scientific principles in the field of nutrition. Our efforts have now resulted in nutrition being accepted as a 'Planned investment' and not just charity. We are now convinced that if we take adequate care of the pregnant women from the third trimester and of the child up to the first $2\frac{1}{2}$ years of his life, he will grow up to be a better citizen and a valuable member of society. If we neglect the child at this crucial time, society in turn will have to not only put up with a second or third class citizen, but the governments will have to spend ten times more to foster such a weak member for his or her entire life time. Nutrition is not charity - it is sound investment in human development.

Next, I would like to place before you the need for communication and I will dwell on only one aspect of communication i.e. persuasive communication. Communication is not just getting ideas across but it should result in favourable action by those whom we communicate. Here we will do well to remember the example of two funnels held together. When we want to communicate with a person and achieve desirable reaction from him, we will have to remember that the point of entry into his mind is the narrow channel of the funnel. We have to find that narrow channel in the first two or three minutes of our contact and enter his mind. We then have got to occupy the whole of his mind, that is, hold his entire attention for a short period of time. After achieving this, we must deliver the message and see that the impression is made. We should then hasten to find the other narrow exit and get out of his mind and let him attend to the other things which would interest him. We should have an 'intent' for our communication. This intention should have a 'content'. These contents must be delivered through a 'channel'. This channel should always be kept

clear and we should guard against 'congestions'. The field of communication is indeed a very large one. In extreme cases we may have to depend upon even 'shock communication'. The sooner we perfect the channels of communication the better we will be able to put our ideas across and get favourable responses for the important subject of nutrition.

In trying mass media of communication we should be cautious not to hurt anyone's ideals or feelings. Here, I would like to tell you about one experience which we had in CARE. We published a million copies of a comic book called 'Laxman Kills The Tiger'. In the story, it was stated that because Laxman ate good food he was so sharp that he could kill the tiger with his arrows. But this concept of killing the tiger did not go well with the people of the Forest Department who were then actually engaged in the 'Save the Tiger Project and it entailed a legal battle. We must therefore realise that we tread on very delicate grounds while dealing with mass communication.

Now, let us briefly consider the question of 'supplementary feeding'. You will have noticed that this type of feeding in institutions is not really 'supplementary'. The mother would always feel that the child is getting something in the institution and stop feeding it at home ; of course for dire economic reasons. But the child eventually gets only a 'substitute' feeding in schools and balwadies. Add to this the danger of failure in our logistics and supply and financial constraints. The mother in the house would not have given any food to the child and this child does not get any food in the school either. Now the supplementary feeding would become 'supplanted' feeding. We should always guard against these three S's. Now it has been recognised that supplementary feeding is not the best way of nutrition intervention. The stress is on nutrition education - again another field of specialised communication.

Then we have to consider two aspects of nutrition. On the one hand we have chronic malnutrition which is the domain of the medical practitioner and we have this subject duly covered in paediatric sciences. The other aspect of nutrition is under-nourishment, which is the concern of one and all. It is several disciplines working together. Starting from agricultural production and national policy for production of nutritive foods, it covers the whole gambit of all sciences upto Public Administration and Education. If our efforts are not concentrated in the prevention of malnutrition, any amount of effort in the curative field will have no meaning.

Regarding the need for training, the fourth dimension of education, I am happy to tell you that we in UNICEF will extend forthright support to

training programmes of any kind. I am very happy to tell you that the project on Nutrition Education and School Health Services which was commenced by the Avinashilingam Home Science College, Coimbatore, was extended to four other institutions in India. Based upon the recent evaluation, this programme will be extended to twelve more institutions including the Home Science College in Hyderabad.

Ladies and gentlemen, with these words, I will end my remarks and because of your concern for the child and mother and the deprived men and women in the slums and villages of India, on behalf on UNICEF I salute you.

Thank you

SESSION - I

Wednesday, July 23, 1980

Chairman : **Dr. S. G. Srikantia**
Former Director
National Institute of Nutrition, Hyderabad.

Rapporteur : **Dr. P. Geervani**
Prof. and Head, Dept. of Foods and Nutrition
College of Home Science
Andhra Pradesh Agricultural University, Hyderabad.

Current Status of Nutrition Education and Agencies Involved

Dr. (Mrs) Tara Gopaldas
Professor and Head
Department of Foods and Nutrition
M. S. University of Baroda, Baroda.

There is no doubt that currently a lot of interest is being evinced in Nutrition Health Education (NHE) Programmes in several quarters. These educational efforts have been made at different levels and implemented by various agencies. A great deal of information exchange has also been going on in the name of NHE. Unfortunately, a large proportion of this exercise is irrelevant, non-specific and vague and often it is even confusing and counter-productive.

The question arises as to who should be our target for NHE. I am of the opinion that the prime target of NHE should be the administrators, planners and policy makers, including the ministers. Persons incharge of training institutions and implementers of nutrition programmes also need this exposure to NHE. Another equally important target group is people like us i.e., nutritionists, food scientists, home economists, and medical and para-medical personnel who are the "experts" in various specialities. The media people including Press and Advertising Agencies, TV and Radio personnel are also equally important, and they should receive relevant NHE.

What ails our nutrition education efforts ?

In most of our current NHE efforts, one basic flaw is the wrong choice of training institutions for imparting NHE training to field personnel. The trainers are totally out of touch with key MCH concepts. Nor are they aware fully of the real major nutritional health problems in the field. Another lacuna in this training has been the tremendous lack of texts, manuals, instructional material and other aids. The efficacy is further lowered by non-arrival of prototype aids and other material on time during training sessions.

The approach to NHE has also been not very sound. Major emphasis has often been placed on cooking demonstrations (*loss of nutrients*) instead of feeding demonstrations. Often, ease of delivering preventive NHE services such as oral vitamin A doses, iron-folic acid tablets etc., are not emphasised during the demonstration. Similarly simple rehydration therapy for child diarrhoeas are also not adequately included. The total absence of viable cottage sector food mix units incorporating inexpensive cereal and pulse ready-to-eat recipes has also been noteworthy.

How can we disseminate the relevant NHE information in a good manner ? Obviously, a comprehensive Project Information Support (PIS) system which is specific to the concerned situation must be built into all national nutrition programmes. The primary target should be informed about the project, who in turn, will inform the community, thus giving a 'multiplier' effect.

Our major nutrition programmes are the Integrated Child Development Services Scheme (ICDS), Special Nutrition programme (SNP), Applied Nutrition Programme (ANP), Mid Day Meal Programme (MDM), Iron fortification, Supplementary Feeding Programme (SFP), Food for Work programme and the Goitre Control programme.

How strong has been the Project Information Support system in respect of the major nutrition programmes ? A comprehensive programme information support implies that the planner, policy maker, and the bureaucrat are informed about the project according to his/her level and need. The primary target population viz. State or District Officials, the trainers, and teachers must be informed regarding the key objectives of the programme, clearly spelling out what their contributions and responsibility are with regard to the nutrition messages. Hopefully, they will, in turn, pass on the PIS to the community. This orchestration must be harmonious and be able to communicate the vital and critical messages of why such a nutrition programme is in existence and what it hopes to achieve. As far as the community is concerned, they would like to know such details regarding the programme as to why, for whom, where, in what manner and by whom, what should be expected from the government.

The most important lacunae in NHE content, media and materials may be considered. Firstly, poor or wrong definition of critical NHE messages is commonly seen. Lack of information or research on most effective media for minimum cost and maximum communication potential: inadequacy among government agencies regarding logistics, media schedules, mass production of

cheap NHE materials or prototype equipment: inadequate and inappropriate NHE orientation and training and scant monitoring and feed-back are the other maladies. Shortcomings on the part of educational institutes were also contributing to some extent to the unsatisfactory situation of NHE. Medical colleges have inadequate nutrition, particularly community nutrition, content in their curricula. There is a need for medical and agricultural students to plan nutrition projects together. In the agricultural colleges, there is rather too much emphasis on cultivation of foods without adequate exposure to public health nutrition.

Some of the large-scale NHE projects undertaken in the past decade in India may be considered.

Nutrition Education by Mass Communication

This project was undertaken by CARE in parts of Andhra Pradesh and Uttar Pradesh during 1972 with the expertise of the Clarion McCann Advertising Agency. The objectives of this project had been to test alternative themes of NHE, to assess the influence of income on knowledge, attitude practice (KAP) and to assess the influence of nutrition programmes in the study areas (Mid-Day Meal programme).

The main theme was feeding more rice/chapati/dal/sag to the pregnant mother and infant (*six months*). Two alternative approaches viz., persuasive approach, and fear approach were tried out. The study sample were from one town and three villages each from U.P. and A.P. The selected sites had more or less same prevalence of nutritional disorders. The same kind and content of media were used. The media employed included press, bill-boards wall-paintings, films, tabloid newspapers, booklets and calendars for influentials and teachers and comics and mime. The target group included influentials, heads of households, housewives, teachers and school children.

The key findings of the project were that fear approach worked better and that there was no influence of income, all income levels easily comprehending the message. There were no significant differences between communicating the message to influentials as against the others. Higher scores of awareness were observed in areas where nutrition programmes were in operation. The project confirmed that nutrition could be "sold" like any other commercial product.

Project 'Poshak'

Also launched by CARE during 1971-1975, Project 'Poshak' envisaged a package of NHE (child care for mothers and their below-threes). About

20,000 mothers in 517 villages in 13 districts of Madhya Pradesh were covered by this project. The content of the programme included basic MCH messages. The concept of feeding more amounts more frequently to the vulnerable children below three years, immunisation and deworming, proper food during illness, utilisation of available public health services and family limitation were the major messages. Food mix units, flip-charts, films, feeding demonstrations, nutritional rehabilitation of children in their huts, films and slide shows were employed.

The major lessons of this project were :

1. Take-Home approach can be made an important tool of NHE.
2. Food-mix-unit within village was an effective method of educating the whole community.
3. The nutritional rehabilitation of the child in his own hut needs medical supervision, but when it can be done, is the most potent vehicle of education of medical/paramedical staff/mothers/and community at large. Highly recommended as a 'must' for medical graduates.
4. NHE cannot succeed in isolation and must be integrated with nutrition or health services.
5. The poorest of the poor will always be a problem. Least participation due to 'work-all-the year round' mothers.

Among the other educational projects may be mentioned the MCH Non-Formal Education Project at Mahboobnagar, Andhra Pradesh; the Madras Slum Education Project 1974-75; the NHE Project for primary school teachers linked with Mid-Day Meal Programme in Orissa and NHE Programme for MCH workers in Manipal.

NHE Pilot Scheme

Since 1976, there has also been an on-going pilot scheme on NHE and environmental sanitation education by the NCERT, Government of India. Faculties or the Colleges of Home Science in Coimbatore, Calcutta, Jabalpur and Ludhiana are participating centres of this scheme. Under Phase I, the activities included are: development of a curricular package, orientation of teacher educators and educational supervisors, training of selected primary school teachers, orientation of key-government personnel and try-out in selected experimental schools. In Phase II, training of all science teachers

educators in participating states and introduction of 5-7 important messages to the community are contemplated. This scheme has been assisted by UNICEF.

There have also been some global NHE projects from which we can draw useful lessons. These include field experiments in using radio and advertising techniques in NHE dissemination in the Philippines and Nicaragua, Mass Media and Non-Formal Nutritional Education Project in Tunisia and Child-to-Child NHE Programme of the London School of Hygiene and Tropical Medicine. In these projects, combinations of mass media and a full complement of educational aids propagating simple nutrition messages and using different 'change agents' were tried out.

The international agencies concerned with NHE in India are UNICEF, CARE, FAO, WHO, USAID and UNESCO.

COMMUNITY HEALTH CELL LIBRARY AND DOCUMENTATION UNIT

Discussion

The following salient points emerged during the discussion :

1. The chief causes for failure of nutrition education efforts are lack of clear-cut goals and use of defective messages.
2. Follow up of educators is essential to monitor the success of nutrition education programmes.
3. Since behavioural changes are envisaged, more and more social scientists must be involved in nutrition education.
4. Mechanics of coordinated operation of activities of Krishi Vigyan Kendras with those of nutrition education centres must be worked out.
5. There should be a compilation of various nutrition education efforts going on in the country for the benefit of workers.

Social and Cultural Factors

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Nutrition education is defined as a means of translating the nutritional requirements into food and adjusting the food choice to satisfy nutrition, cultural, psychological and economic needs. It is a process by which beliefs, attitudes, environmental influences and understanding about food, are converted into practices which are nutritionally sound and consistent with the socio-economic background of the individual. [1,2]

Nutrition status of a community, especially of the vulnerable segments of the population, is influenced by numerous complex, interacting forces. Poverty is of course a serious limiting factor in most of the developing countries. Poverty syndrome is characterised by low income, low educational levels, poor sanitary conditions, diminished food intake, repeated episodes of infections, too many children, births too closely spaced, family instability, low parental attention and low social status in the community.[7] Cultural taboos, superstitions, lack of scientific knowledge of food and nutrition also contribute greatly to this poor nutritional status.

Lack of understanding by the community of the developmental and welfare activities undertaken by the various agencies, in the area is yet another factor leading to malnutrition.[5]

Heterogenous audience :

The audiences for nutrition communication come from different backgrounds, cultures, economic levels. Therefore, they need to be given different messages. A thorough familiarity with, and understanding of each set of audience is mandatory for translating the general messages into a specific message beamed to it. The 'message' can easily be "turned off" by the community if it is not appealing or not realistic or is in conflict with social or individual values or if it is irrelevant.

It is realised that much of what to communicate, and how, depends on whom to communicate. Intent will differ according to situation and circumstances of the recipient. But every learner is a concrete being. His personality is determined by a complex biological, physiological, geographical, sociological, economic and cultural factors. Apart from nutritional, economic and sensory considerations, personalness, appropriateness, convenience and health apprehensions are some other parameters by which consumers judge foods. These parameters may not be given equal priority by a given consumer and they also vary from consumer to consumer. Various food products can be perceived by consumers as having quite different profiles across these parameters.

Then comes the question whether a particular idea, attitude or belief about a given food does really play an active role in a person's decision to select or reject that food item. It means that one has to locate perceptions that 'count'. In the field of foods, particular attention must be given to problems relating to the home-maker. Health and nutrition, sensory, aesthetic, economic, market knowledge, family wishes, time pressures, preparation-process, prestige are some of the parameters that a home-maker will use in addition to the above parameters. So, when it comes to a home-maker and specific foods, communication effort must take into consideration (1) what product profiles represent the positive appeals for the given food ? or (2) what factors operate to dissuade a home-maker from making use of particular foods ?

Throrough understanding of community :

So, nutrition educator must know his community as intimately as possible. He has to observe and participate in the society. This would help in developing relevant nutrition education programmes and increase the validity of interpretation of the data. The worker must also seek to achieve a certain identification in dress, language, dialect etc. in order to encourage free exchange of ideas, and frank discussions. Family eating patterns, marketing and purchasing system, available equipment, labour, fuel, money, time etc. need to be understood. Availability and utilization of health services need to be studied. Food beliefs and habits should be studied to enable introduction of the desirable changes for improvement within the frame-work of their value systems.

Assessment of the health and nutritional status of the people, diet surveys, socio-economic surveys, interviews afford an excellent opportunity to

learn about the community and to develop a nutrition education programme which is in close correlation with the family and community life.

Food habits, beliefs and attitudes are so localised that they differ from area to area; sub-cultural variations are also observed. To illustrate an example, data drawn from an action-cum-research project conducted by the Council for Social Development, New Delhi, and financed by UNICEF are presented here[6]. The target population was illiterate, pregnant and lacta ting women from forty four villages in five Blocks of Mahbubnagar district of Andhra Pradesh.

TABLE 1

Food Items that were Reported as Taboo During Nursing Period by Caste Groups (Percentages)

Food items regarded as taboo	Caste group			
	Scheduled castes n = 224	Backward castes. n = 761	Upper castes n = 121	Total n = 1106
1. Pumpkin	78	77	81	78
2. Papaya	69	71	71	71
3. Amaranthus	55	54	56	54
4. Eggs	53	50	49	50
5. Banana	43	49	55	41
6 Brinjal	39	37	38	37
7. Buffalo milk*	54	35	12	36
8. Chicken meat*	41	31	25	32
9. Water melon	34	29	36	31
10. Bottle gourd	23	19	13	19
11. Pulses	20	16	14	16

* Chi square value was significantly different from zero at 0.05 level.

From a list of 12 foods which were known to be taboo foods in this area during lactation, each item was read out one by one and the respondents were asked whether they consumed it during lactation or not. Foods avoided

are mostly protective foods. Significant differences were observed between the three caste groups. The percentage of avoidance of buffalo milk and chicken meat was observed to be more in scheduled castes and backward castes than in upper castes.

Such sub-cultural differences within the community can be exploited by the nutrition educator. There is scope for alterations in these beliefs when the groups have an opportunity to interact. Nutrition educator's job is to provide a common forum for them to discuss such of the beliefs and help them to come to a group consensus which is scientifically sound and socially approved. This is observed to be possible in the non-formal education programmes.

Assessment of nutrition learning :

Socio-economic and cultural factors influence not only nutritional status of the people but also the learning abilities of the individuals. So it is also necessary to identify such of the factors influencing nutrition learning.

An experiment on nutrition education programme for rural women was conducted in a village in Coimbatore district[4]. The target group for the experiment were illiterate, pregnant and nursing mothers belonging to low income group. There were about 55 respondents who participated in the non-formal nutrition education programme between October and December 1975.

They were taught different aspects of nutrition through dialogue and food demonstrations. The gain in nutrition knowledge was calculated by taking the score for a set of questions before and after the nutrition education programme.

To identify some of the factors associated with nutrition learning, the respondents were classified into three groups (1) below average (2) average and (3) above average group, based on their overall gain scores in nutrition knowledge. Those who got a score less than 20 out of a total of 52 were classified as "below average" group who obtained a score between 20-25 as average group and those who scored more than 25 as above average group.

A negative correlation with age of the respondent, family size and number of children alive was observed and a positive correlation with per capita general expenditure of the family was noticed.

A respondent in the 20-25 years of age range with a family size between 4-5 with 1-3 children, with per capita family general expenditure above Rs. 40/-

per month could gain greater nutrition knowledge through non-formal nutrition education programme. They attend the nutrition classes frequently, practice the recipes, demonstrated more often and disseminate the messages to the community (Table 2).

TABLE 2

Percent of Attendance, Recall of Recipes Demonstrated and Percent who Communicated with others in the three Groups.

Group	Percent of attendance	No. of recipes recalled	Percent who communicated with others.
Below average	77.3	2.4	31.0
Average	85.5	4.3	77.8
Above average	92.7	6.0	77.0

Such of the potential learners were observed to pass on the new learning in nutrition to their neighbours, sisters, sisters-in-law, co-agricultural workers and elders. Such form of learning is an age-old custom and is more accepted and effective in traditional bound societies. Thus a few of the well informed would act as change agents in the comunity.

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Discussion

The following salient points were discussed :

1. Attempts to remove the technical backwardness of the comunity must be simultaneously taken up for ensuring maximal impact of nutrition health education.

2. Multiple intervention at different points in the vicious circle of malnutrition is essential.

3. Studies designed at measuring the response of recipients are essential to refine the techniques of communication.

4. Evaluation must attempt to measure the extent to which the set goals have been achieved rather than merely list out impressive figures on coverage etc,

SESSION - II

Wednesday, July 23, 1980

Chairman : **Dr. L. D. Swindale**
Director
ICRISAT, Hyderabad

Rapporteur : **Dr. (Mrs) K. Chittemma Rao**
Project Officer, Operations Research Project
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Role of Agricultural Extension in Nutrition Education*

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We are 660 million people in this country. About 48 per cent of us are below the poverty line, i.e. with an income of Rs. 65/- per month in rural areas and Rs. 75/- per month in urban areas. This low income does not help in providing two meals a day and a large number have to go to bed with 'empty stomach'. Invariably, everyone of this large number of 320 million people are undernourished and, therefore, succumb to multifarious ills of diseases.

Meeting the nutritional needs :

Among the 340 million people who are said to be above poverty level, a good percentage are also under - and/or malnourished due to various reasons: poor living conditions, non-availability of nutritious food items and above all ignorance of balanced diets. Thus, while about 60 per cent of the human population in India are undernourished, over 80 per cent are malnourished. Strengthening our nation calls for strengthening the physique and health of our people. Every possible step must be taken to improve the nutritional quality of the diets of the people, through the length and breadth of the country and in all walks of life on top priority basis. This would mean that we have to increase the productivity of our agricultural lands so as to make available the required quantity and nutritional quality of commodities for the people, including the ones below poverty line.

India is an agricultural country and will remain predominantly so for many decades to come. Over the past three decades and more, we have been able to reduce only marginally the percentage of people engaged in agriculture and related activities in the country. Most of the 75 per cent of the people living in rural areas are dependant on agriculture. Of the 320 million people who are below poverty line, 80 per cent are in rural areas and are mostly engaged in agricultural operations for a living.

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*Paper read by Dr. V. Nagarajan, Asst. Director General (Nutrition) ICAR, New Delhi.

Vital sector affected :

The problem of malnutrition is widespread among the peoplewho are to help the nation to wipe out malnutrition. Unless we improve agricultural economy we will not be able to even make a dent in solving the nutritional problems of the country. For improving agricultural economy we should place agriculture on a scientific footing. While scientific knowledge is available with us, transfer of knowledge to farmlands is not adequate. Therefore, we have to carry out more of agricultural extension works.

Agriculture in broad definition covers field crops, horticulture, animal husbandry and dairying, fisheries, forestry, agricultural engineering and post-harvest technology, home economics and related areas of social sciences and humanities. Though agriculture in a limited sense would mean production of crops, post-harvest handling of produce, marketing, processing, storage and preparation in the kitchen, are all equally important. Home economics deals with some of these activities and has, therefore, a rightful place under agriculture. Nutrition being an integral part of home economics, is closely interlinked with crop production, animal production, fish production, processing of products, preservation and proper use of the various commodities. Therefore, if there should be an improvement in the nutritional quality of the diets of people, every branch of agriculture, including home economics, should be placed on sound scientific footing. This would mean, there should be more of research, teaching and training in all these branches of agricultural science.

While specialisation in agricultural science is essential to widen the frontiers of knowledge in each branch, interdisciplinary approach is essential to deepen our knowledge in any given branch. It is, therefore, necessary that everyone involved in agricultural research whether he be a crop breeder, soil scientist, agricultural engineer, animal scientist or agricultural economist, should possess a basic knowledge in human nutrition and likewise home economists should have a basic knowledge in crop production and related areas.

Coordinated extension work pays :

Agricultural extension is in effect adult education carried out with audio-visual aids. In educating our largely illiterate, but economically alert and practically experienced farmers, field demonstrations and personal contacts become very necessary. In transferring the technology from the 'centres of knowledge' to the rural areas, extension workers have to necessarily move to villages and get into close contact with the farming community. Various rural

development programmes in different fields revolve around farm homes and, therefore, are inter-linked. To carry newer knowledge from the laboratories or experimental fields to the farm homes we employ extension workers of various categories and designations. Each one of them approaches the dwellers in the same farm home as the target. While they seem to function independently, mostly ignorant of each other's programmes, the farm dwellers get confused and the end results are poor. It is essential that there are proper linkages between the various developmental programmes so that the farmer gets the best benefits.

Presently, extension work in human nutrition among rural population is very weak. As already stated, improvement of human nutrition is basic for any improvement in rural as well as urban society. But the task of nutrition education among the rural poor is stupendous and voluminous. It is not possible for the presently available limited number of human nutrition extension workers to cover the field. It is, therefore, necessary that every one of the 'transfer agents' employed in the fields of agriculture, animal husbandry community development, etc. should carry with him information on human nutrition and transmit the same to the farming community as an integral component of the extension 'package'. Also, the average level workers, who have the multi-disciplinary responsibility should not only possess adequate knowledge in human nutrition but should also devote more time for human nutrition programmes. Their knowledge and skill should be updated and improved in a continuing manner through periodic in-service training programmes so as to make them more effective and efficient.

Strengthening the infrastructure :

In India we have several institutions carrying out research work on human nutrition. Though these are inadequate to cover the multitudes of nutritional problems which are deeply entrenched in different socio-economic environs of our country, the available knowledge on the subject should be fully utilised to reduce malnutrition. The National Institute of Nutrition has been doing pioneering work in many areas of human nutrition. Several other laboratories in the General as well as Agricultural Universities, including the Andhra Pradesh Agricultural University, have done very valuable work on problems of human nutrition and in carrying the knowledge to the rural areas. We must improve the infrastructural facilities for transferring the knowledge more effectively from the research centres, for which purpose we need more "Trainers' Training Programmes". It is in this context that basic training in human nutrition for various extension workers becomes important.

Role of Home Science Wings :

Agricultural Universities in India have been given the triple responsibilities of teaching, research and extension education in different branches of agricultural science, including home science. The colleges of Home Science in the Agricultural Universities, not only teach under-graduate and post-graduate courses in Home Science, but also carry out research in different branches of the subject. They also carry out extension education programmes by training the extension workers. Besides, they offer basic courses in human nutrition for the benefit of students in the colleges of Agriculture, Animal Husbandry, Fisheries, Agricultural Engineering, etc. By strengthening these programmes we would be able to strengthen extension activities in human nutrition among rural people.

The Home Science Colleges in the Agricultural Universities have to train not only more number of under-graduates but also middle level extension workers. There should be pre-service and in-service training programmes for various categories of extension workers. In doing so, the Home Science faculty will be able to maintain a continuing link with the extension staff and the farm families, which would help in rural orientation of the teaching and research programmes. Thus both agricultural extension and nutrition education programmes could derive mutual benefits serving the cause of economically and nutritionally poor communities in the country.

Discussion

The following salient points were discussed :

1. Our training potential, institutional and otherwise, must be strengthened.
2. Agricultural extension workers must be better oriented to health/nutrition needs of the farmer groups.

Role of Regional Home Economist

Miss T. Padmasini Asuri
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Complexity of Nutrition Education Process :

While the nutrition education process may have the goal of increasing the consumption of a particular food, it becomes imperative, that food becomes increasingly available and be distributed within the population. To yield fruitful results, nutrition education should synchronise with the production of those foods at the same time, be within the reach of the people who need it most. In order to ensure justifiable distribution of these foods economic betterment needs to be ensured. Even when food becomes available, its proper utilisation is deterred by factors such as cultural beliefs, postharvest handling, tradition and others. To explain this situation, Applied Nutrition Programme is taken as an example. In the past, when it was decided to promote the consumption of egg, many poultry units were started. But when eggs were produced, their cost was far too beyond the capacity of the target group. The egg, however good its nutritive value may be, was still not the food for this needy group. Hence alternative sources were sought and the nutrition education also had to be changed as a consequence. Such a close look at nutrition education calls for training of other policy makers and supervisors in understanding the support activities required for the education process. Nutrition educators also require training in the process of effective communication. To make them effective communicators, there is this need for planning and implementation of other support activities. The role of Regional Home Economists is discussed against this background.

Regional Home Economists are the Regional Officers of the Directorate of Extension under the Ministry of Agriculture. Their offices are located in Bangalore, Calcutta, Agra and Bhopal. Providing support and help to the state governments in the organisation of nutrition education programmes is one amongst the various other activities. Following are the activities where the Regional Home Economists are involved.

Training of Trainers :

Training in nutrition and nutrition education, is imperative for everyone. But the district officers need orientation to draw up a Nutrition Education Plan for the district. Those officers of the development departments who are responsible for the production of foods need to know the nutritional contribution of these foods and project their production output, maintaining a balance between overall production of foods and meeting the nutritional requirement of the community. In addition, the policy makers need to be oriented to plan for support activities for nutrition education. This approach not only calls for planning strategies but also anticipating the needs. Most often, orienting these district officials themselves on facts of better nutrition becomes a necessity. This is not an easy task to be achieved, as their concept and understanding of nutrition education is very limited.

Support to the State Government:

Unless the state level planning is done for nutrition education as part of nutrition programmes of the state, the efforts at the field level become meagre and not stabilised. The success of the programme depends on the interest of the state government officials. Much of the planning needs to be organised at this level to give support for the field level. Preparation of support communication materials is one such task. It means collection and monitoring of nutrition problems of the state, understanding the resources, reasons for the existence of such problems, and also the coverage required. A set of visuals prepared on these considerations, need to be pre-tested before making the investment. The set of Tamil Nadu charts is an effort of Tamil Nadu state government with the help of the Regional Home Economist.

In addition to each state preparing the visuals, many of the organisations, are already preparing a lot of materials, some of them very interesting, some with wrong information, some repeating the efforts of the others. Regional Home Economists' offices collect all the materials from different sources and where necessary appropriate remarks have been communicated.

Utilisation of hardware and treatment of software :

In the process of nutrition education the communication messages need to be tested before they can be enlisted in the process. The thrust in Nutrition Education recently has been mainly on diet of the children and infants. As we all know much of the malnutrition among children is due to faulty feeding. Peter Greaves had enlisted the universal eight messages, that should be known to every mother. Marasmus in children as well as infant mortality

could be well prevented to a large extent if these messages are understood and practised by these mothers. However, the message may be important but it still depends on how it is communicated to the mothers. One has to see the reaction of the mothers to these messages. One such message is 'feeding young children five to six times a day'. The literal transmission of such a message left the impression that it was not meant for poor people as they can hardly cope with the 3 meal patterns : The reactions of the mothers to those messages need to be understood and the workers at the field level should have adequate empathy.

Sometimes messages are so decoded that it becomes difficult to understand.

Another difficult message that all of us are anxious to communicate is the importance of continued feeding in illness. This message requires to be supported by activities like providing the food to the sick child and feeding under observation. The other message is that the expectant mother should eat for two to provide adequate nourishment to the foetus. But there is always a fear that eating well would result in difficult child-birth. The complex nature of such messages must be understood by the field workers.

Training of Field Workers :

Recognising the gaps as mentioned earlier, the Regional Home Economist has to design the course to provide this training for the workers. In the training the feasibility of increasing food production which can be linked up with nutrition education must be emphasised. There is a general statement styled:utilisation of local foods should be promoted in the nutrition education. This entails understanding the food situation in general, understanding the cultivation of foods, the impact of the market on the purchases made, and the ritual the people attach to the food. Thus the nutrition education for the women given by the field workers, has to meet three facets of the programme. Making the women cultivate the foods that are nutritionally desirable and enabling them to utilise these foods, is the first facet. The second facet is the management of both time and resources available for women. Feeding an infant does require a special food preparation and patience. The mother should learn to manage the cooking time and fuel so that this special requirement of the child can be met. The third dimension is understanding by the women of the quantity of food that is required for the individuals in the families. All these three facets are interlinked. A simple message like ' Feed your child with semi-solid food five or six times during the day' demands making the mother grow foods like greens, manage her time to mash up the

food and feed the child and understand the quantity the child requires. These are all included in the training of these women workers in order to enable them to plan their programme.

Relating Nutrition Education to the Training in Food Production :

Though nutrition education is ever thought of as a realm where the rural women are to be taught to learn, there is an actual need for planning agricultural production in relation to nutritional requirement. While giving training to the farmers, specially in the cultivation of high yielding varieties, one of the points stressed is the fact that these varieties provide better food value per hectare when compared to the local ones. Many a time farmers grow the foods but do not use them. Nutrition Education process as part of the production information therefore becomes essential. Farmers who grow carrot, concentrate on the carrot but they themselves do not use the leaves which can contribute a lot of vit.A. Similarly the farm families themselves should realise the wastage in nutritional value if insects infest the grain. This means that the trainers of food production should also highlight the nutritional concepts and relate them in their production information and also include information on post-harvest technology.

Many scientists have brought out the essential fact that mere increase in food production or the productivity of land does not ensure better nutritional status of the community unless this is supported by related activities like processing, storage and distribution and the people concerned are able, as well as willing to eat what is produced or supplied. We have instances where the foods supplied under 'Food for Work' are exchanged for better looking, but expensive grains.

The test labs of the Regional Home Economists are always involved in finding out better cooking quality of newly evolved foods or utilising less known food like *Prophocarpus tetragonolobus* (winged bean), soya and others. Cooking methodology is also evolved to help the mothers manage inclusion of additional food without much strain on their resources. These findings are communicated to the training centres as well as the state government for including them in the training sessions and lessons. Recently the Regional Home Economists have adopted the Nutrition Garden approach to nutrition education for solving malnutrition in the community.

Providing Support to the Nutrition Education :

In addition to the training, the workers require continuous information support, based on the problems and priorities fixed. The messages have been

processed and compiled into a book published by UNICEF for wider distribution. One such effort is the flip book and the manual. The powerful media like radio, TV and press are showing interest in the subject of nutrition. Producers of radio programmes require help in collecting factual information. Radio talks synchronising with the activities at the field level were given. Regional Home Economists assist in providing "Nutrition Lessons" on the air. Demonstrations were planned over TV during the time of Satellite Instructional Television Experiment. Even though many did miss demonstrations, basically it is the poor who benfitted by the programme as they did not mind sitting on the ground to see the TV. The study on the impact of the messages showed that this group of women received the messages.

Mere production of visual aids or posters would not complete nutrition education. Their placement for the benefit of the community also becomes very important. Some studies made by the Regional Home Economist showed that any poster pasted on the wall of the well is noticed but not the ones on any wall or of a dispensary. Such posters also needed pointers of attention to make the women get attracted to the message. Nutrition Education is not a programme for women alone. It should be for children, as well as other adults. Methodology to teach nutrition through games and songs must also be designed. The booklet "Let us Play" brought out by UNICEF and the chart on Snake and Ladders (published by Tamil Nadu) on Nutrition were originally designed by the Regional Home Economist.

The Problems Faced :

Unless the supervisors have a proper understanding of the subject there can be no sustenance of these efforts. However cheap the local resource may be, still it may be out of reach for many. Relating nutrition to health continues to be a difficult theme to communicate. Adequate support at all levels and planned nutrition education are lacking. Commercials have a powerful influence and offset meagre and sporadic nutrition education processes. Unfortunately, nutrition education is often measured in terms of number of demonstrations done, meetings conducted or films shown. Apparently, people do not tend to distinguish the difference between education and the means to the process of education.

Conclusions :

It is necessary to have a plan for nutrition education. It is also necessary that nutrition education is incorporated into Agricultural Universities.

There must be more and more planning of crop production in terms of nutritional needs and nutrition education should then be planned at field level in relation to crop production.

Home Science colleges should share their experience in nutrition education, test their approaches and assess the needs. There is a large scope for Regional Home Economists and Home Science Colleges to work on these aspects.

Discussion

The following salient points were discussed :

1. The nutrition education efforts must be beamed to the entire family as a unit and not to the mother alone.

2. The basic and close association between food and healh must be brought home to the targets in all nutrition education campaigns if we want attitudinal and behavioural changes in relation to diet.

Communication Methods in Nutrition Education

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The need to promote nutritional well-being need not be reemphasised at a gathering like this. Malnutrition persists in existing in spite of our multi-pronged efforts. In our frustration of not being able to see any tangible improvement in the nutritional status of the vast number of people we have a tendency to blame poverty as the root cause.

Yes, poverty is the reason! More than economic poverty, poverty in knowledge is the cause for poor nutrition in many people.[1] In our community the many children who go blind every year due to lack of a little vitamin A, living right in the midst of luscious stretches of fresh greens, are proof of this poverty in knowledge.

The other classic example is that of Moola Singh of Punjab[1]. He was quite happy with his daily fare of *chapati*, dhal and curd while he worked in his fields. Then came the green revolution and Moola Singh became very prosperous. He felt that he should live like rich people of the cities and hence substituted his meals with tea, biscuits and a slice of bread. Often, nutritionally inferior foods are substituted for nutritious and even cheaper foods, because of notions of false prestige, ignorance etc.

Ceeting the challenge :

It is at points like this that nutrition education would provide a clear-cut answer to meet the challenge of poverty in knowlege. In spite of a widely held belief that there is something about the uninformed that makes them harder to reach no matter what the level of information, concerted efforts of education, implemented properly, will yield results.

Most of us, based on our experience, still believe that providing adequate knowledge regarding food and nutrition will help to bring about a behavioural change among the people with regard to these matters. Nutrition educators and nutrition education have an important role to play.

People derive their nutrition/health knowledge from two types of sources. One is the formal, standard teaching: A doctor's advice in a crisis: instructions of the midwife at child birth etc. The other and more powerful source is informal; it is a more casual dissemination of knowledge and on the whole a more passive, non-obvious process. In this the person is unaware of how he acquired the knowledge. It seems to merely happen. In many ways it is more deep-rooted.

Raising the nutritional status involves bringing about desirable changes in people's attitudes towards foods and eating and often making them accept new and unfamiliar ideas. Here the great need is not nutrition in the classical sense of a biochemical discipline. What we urgently need is a science that teaches people how to use available foods, cook them the preserve to nutrients and helps them understand why the nutrients ought to be preserved and eventually makes them eat.[2]

Preventive vs curative approach :

The importance of nutrition education can be seen in many ways. For example, it is generally understood that preventive methods for improving health and nutrition are better than using curative methods. A preventive health system implies not only the provision of resources such as medicines, vaccines, food, sanitary facilities etc., but also an inclination and ability on the part of people to use their resources in the proper way.[3] Here arises the need for providing effective nutrition/health education. The present approach seems to be sadly lacking in something, for, not much seems to be achieved. Most current-day health education programmes fail to give the satisfaction of having achieved anything at all. The travails with programmes like the Applied Nutrition Programme are too well known.

We are progressively growing more concerned about the deficiencies in nutrition education. We seem to be faced with an application gap that threatens to widen into a yawning chasm. Now there is a mammoth challenge to build bridges between knowledge or immense technical know-how on one side and their application on the other. Is this gap perhaps a child of a communication gap ? Are we unable to convey the proper meaning to communicate ?

What is the process of communication ? "Communication" stems from a Latin word meaning 'Common'. When we communicate we are trying to establish a commonness with someone. We are trying to share information, an idea, or an attitude.

The Communication Process :

Communication always consists of three elements. The source, the message and the target. The source can be one individual, an organisation or a group of people. The message itself can come through various channels. Ink on paper, sound on waves, electronic waves, a flag on a pole etc. The target can be an individual or a group.

When the source tries to build up this commonness with the target he encodes his message. Encoding can be the spoken word-which may not reach very far. It can be the written word or symbol which travels more slowly but lasts longer. Once the message is coded, it is free of the sender. The sender can rarely do anything about it.

To complete the process of communication the message must reach the target and be decoded correctly. This is very important.

This system is strong only as its 'weakest link'. It can break anywhere. Perhaps the source does not have total or clear information. The message has not been encoded correctly or fully. If the message is not decoded in the pattern that corresponds to the encoding or if the target is unable to handle the message it receives, to produce the desired response, the system works at less-than-top efficiency.

Perhaps the most important aspect of this process is that the receiver and the sender must be in tune, and operate on the same wavelength. When we are dealing with human sources and human receivers the establishment of a wavelength is a little more complicated.

Field of experience :

The source can pass on information and the target can receive information only as far as their fields of experience permit. Both can meet and exchange ideas only if their fields of experience overlap or are common. If the fields of experience have a large area in common, communication is easier. If they are not, it is very difficult to get the meaning across. This is what happens if you talk abstract, advanced mathematics to a man who has no concept of numbers. Or when a sophisticated urban based group tries to

communicate with the culturally different rural community or even urban poor.

The message has to be coded with symbols which mean the same thing to both the target and the sender. A papaya is full of vitamin A to the scientists of National Institute of Nutrition, but it has something in it which causes sterility to Yadamma from Singaram Village. The same symbol has two different meanings. How do we ensure that the symbol means the same thing? It would, if the field of experience is the same for both the target and the source. One or the other should extend his experience to cover more areas of the other. Usually it is the sender who is forced to do this because it is he or she who started the process.

One way of widening the experience is by feed-back, the other important ingredient of the process of communication.

Feedback and Action :

When the sender's message is received by the target, he or she usually communicates something back to the source. This is the feedback. It is important because it tells us how the message has been received and perhaps what happened after the message was received. Particularly when we send out health or nutrition messages, we expect some kind of a reaction and some behavioural change, perhaps as a result of the new knowledge received through the communication.

But action depends on the field of experience or the knowledge, attitudes, practices and environment of the receiver. The efforts of health or nutrition educators to widen their field of experience along with that of their target are often haphazard and have many shortcomings.

Feedback vital :

Listening to them (*target*) is a very important ingredient of the communication process, without which the whole effort can breakdown and create a gap. Communication is a process-an interaction between two entities. Every entity is equally important, capable. It will definitely be worth the while to listen to the target before the communicator beams any information at them.

Development economists have coined the term "Rural Development Tourism" to connote the brief visits paid by urban based professionals to gather information. They come from far, stay for a short time, probe, prod and go away.

Our present day methods of data collection and pilot survey before planning a communication programme, if they exist at all, have the tendency to be restricted by some of the following loopholes :

1. Communities near towns are taken for survey
2. Regions more developed tend to be investigated.
3. Users of services attract attention while non-users tend to be ignored.
4. As the uninformed are difficult to reach, they continue to be uninformed.

For example, the "comprehension threshold" of the audience was not at all kept in mind while many of the programmes on nutrition were produced by the Satellite Instructional Television Experiment (SITE) Telecasts. This was done inspite of the information being available to show that the population could comprehend only 3 bits of information through that channel while they were presented with anything from 5 to 53 bits. Thus our efforts to widen the field of experience are perhaps not really efficient.

Most education programmes are planned without any understanding of the basics of this process. Hence the gap and the failure to trigger any behaviour change.

Skills for Action :

Let us try to understand what we mean by nutrition education. Nutrition education is the process which enables individuals to gain an understanding of and skills necessary to promote and protect their nutritional well being through their food choices. Education is not passing on information. Education should incorporate and recognise the need to develop skills for action, assist the individual to act and help to apply the information to one's own life.

There is a widespread confusion between health education and health information–the latter involves passing out pamphlets, giving lectures, pasting posters etc; all provide information without an opportunity for reaction or participation. The term nutrition education connotes modifying behaviour, which is not a small task. If we view many of the current education programmes in this light we may perhaps understand why many of them have failed.

Research in the field of communication throws some hints for health education. Impersonal sources such as mass media, film strips, slides which are merely one part of the process of communication being merely channels, are poor means of changing behaviour, when used by themselves. They merely create an awareness of the desired behaviour change.

The process should be implemented entirely, totally to be effective. Media are merely educational aids. Education itself should be a communication process planned as part of the total community intervention strategy.

The communication gap will cease to exist if nutrition educators become nutrition communicators giving equal importance to the target as well as message.

When the SITE Programmes were telecast a few years ago, the National Institute of Nutrition undertook a follow-up study[4] of some of the nutrition telecasts. The study found that TV did not seem to be a very successful medium in the existing and available socio-economic context. And it has come out with some specific recommendations. These are nothing but points which show why the process of communication was not complete.

In this paper, Ramadasmurthy and group highlight the need for closer cooperation between subject specialists and TV producers to obtain more background information so as to improve the quality of telecasts. Secondly, they emphasise the need for research into the felt needs and aspirations of the people so as to produce programmes more interesting and attractive to the target. Thirdly, the development of extension and infrastructure support is stressed.

Thus it is clearly demonstrated that audience or target research should be given extra importance before starting a communication campaign.

Let us become communicators and not just remain information mongers.

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Discussion

The following salient points were discussed :

1. Better communication can result if we simplify the messages. More than that, it is always desirable to concentrate on a few core messages which are action-oriented.

2. Wherever possible, interpersonal communication must be resorted to. Parallel communication i.e., reinforcement of the same message through different channels must be planned for impact.

SESSION - III

Thursday, July 24, 1980

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Mass Media and Techniques

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Mass Media are physical bridges between sender and receiver of messages. They are organised devices for transmitting mass communication by which useful messages are got across to the intended masses with a purpose, intent and objective. Mass Media are part and parcel of mass communication programmes.

Mass communication, simply stated, is communication to the masses. It is defined as the relatively simultaneous exposure of a large, scattered and heterogenous audience to stimuli transmitted by impersonal means from an organised source for whom the audience members are largely anonymous.

Therefore, mass communication is the end and mass media the means or channel for transmitting the mass communications.

Why Mass Media ?

Mass media provide better extension educational service. Our problems for transfer of technology appear to basically depend on two factors. First, scientific and rational prescriptions to specific problems and second and more important, dissemination and diffusion of information to the people who need to know the information.

Despite all efforts in guided social and technological change, results of the developmental programmes leave much to be desired. This is not so much due to inherent defects in the programmes, but due to the lack of effective exploitation of total manpower and effective communication between technologists (*those who know*) and the rural families (*those who need to know*). Communicating in a manner so that technology is received, understood, accepted and adopted is the need. It appears, that an optimum combination of the scientist's skill, the political will, administrative understanding and efficient communication and media utilisation is the need of the hour.

On a constraint analysis, it looks as though the basic problem is the need for wider application of the knowledge already known to us. One of the main reasons why rural families follow the traditional methods is because most of them are not even aware that better ones exist. What is needed is, simple, lucid, visual, interesting and understandable messages, in various, appropriate forms.

Our problems could be briefly summarised and categorised into three major groups of (i) inadequacy (ii) illiteracy and (iii) inaccessibility. If we could afford, in terms of efficiency and effectiveness, inter-personal communication or face-to-face interaction is the best. But this does not seem to be anywhere near a possibility for, the people who know and have adequate and appropriate information are few and the people who need to know are many.

Mass media can increase the efficiency of the field functionaries, academicians and researchers and others who generate new knowledge and desire to communicate the same to strengthen their programmes in terms of creating awareness, interest, evaluation, trial and adoption.

The Essential Attributes :

1. *Credibility* : Communication starts with a climate of belief. This is built up by performance on the part of the source. The performance should reflect an earnest desire to serve the audience. The audience must not only have *confidence* in the source but also a high regard for the *competence* of the source on the subject.

2. *Context*: A communication programme must square with realities of its environment. Mechanical media are only supplementary to the word and deed that take place in daily living. The context must provide for participation and feed back. The context must also confirm and not contradict the message.

3. *Content*: The messages must be compatible with the value systems of the target and be relevant and meaningful to the audience. In general, people select those items of information which promise the greatest rewards.

4. *Clarity*: The message must be put across in simple terms. Complex issues must be compressed into themes, slogans, or stereotypes which are simple and clear. The farther the message has to travel in terms of people, the simpler it must be. An institution should speak with one voice and not many voices.

5. *Continuity and consistency*: Communication is an unending process. It requires repetition for active penetration. Repetition with variation contributes to both factual and attitude learning. The story must be consistent.

6. *Channels*: Established channels of communication should be used which the receiver (audience) uses and respects. Creating new ones is difficult. Different channels have different effects and serve in different stage of the diffusion process of awareness, interest, evaluation, trial and adoption.

7. *Capability of audience:* Communication must take into account the capability of the audience. Communications are most effective when they require the least effort on the part of the audience. This includes factors of availability, habit, reading ability and the receiver's knowledge.

Classification of Media :

Media could be classified in a number of ways depending on the objective. The simplest is based on the perception of the five senses. There is another way of classifying the mass media. The spoken word, the written word and the visual.

The Spoken word: When you want to reach people who cannot read or write, spoken word is the best.

While talking, we use the channel or medium of spoken word. We do the same when we use the channel of radio or the tape recorder. Much of the communication with and by the rural families is by making use of the spoken word.

While speaking, we must be careful to speak slowly and at a speed that is comprehensible to the audience - about 100 to 120 words per minute should be a good average. The pitch must be audible and the speech clear and soft enough to be understood. The words used should be familiar to the audience. The sentences should be short. Unknown words should not be used to explain the unknown. The spoken word must fit into the audio - culture of the audience, interesting and motivating the audience.

Writing a spoken word' more particularly for the radio has to be based on sound rather than sight. It follows the rule of good conversation. It is more direct with simpler sentence structure.

Traditional Folk Media :

The traditional folk media, which succeeded in the past, continue to be significant even today. They have a remarkable grasp over the different seg–

ments of rural society because of their acceptable idiom, functional significance and entertainment. We cannot afford to ignore the traditional folk media just because the modern media of communications are effective enough in terms of wider diffusion of information. Actually, the radio and TV and such other media like the film are copiously using the traditional media. There are a number of advantages which weigh in favour of this idea.

1. Traditional folk media are most intimate with the masses in all the regions of the country. Their primary appeal is to the emotions rather than to intellect.

2. They command an immense variety of forms and themes to suit the communication requirements of the masses.

3. They are local and live and are able to establish direct rapport with the audiences as they antecede the masses.

4. They are flexible to accommodate new themes.

5. They are enjoyed and approved by all the age groups.

Various forms of traditional folk media include the folk theatre, puppet shows, folk music, *harikatha*, *purana kalakshepam*, *burrakatha* and various songs rendered at harvest, planting etc. in the rural areas.

What is needed is to identify the talented individuals and groups who are adept in the various forms and utilise them.

The Written Word:

The written word has power. When written well, it convinces and motivates people. Its power can be made use of (when people can read) in leading them to action. The written word, particularly printed word, has prestige and authority and can be put by for reading another time more leisurely and can be referred to any time to refresh memory.

The easier the writing is to read and to understand, the greater its human interest and more likely it will be read.

The Visual or the Picture word :

The visual or the picture word includes also the gestures we make to communicate. The visual or the picture word is also a symbol. The picture word is clearer and more precise than the spoken or written word. The real object, or a picture of it, can tell people exactly what to convey to them,

Photographs, illustrations, exhibits, slides, filmstrips, films, models all these convey ideas and information fully and well. Communicators call the picture word "the visual". Some visuals can stand by themselves and convey the message. Others need to be supported by the spoken or written word. In a communication situation when visuals are used to make an idea clear, they become visual aids.

A suitable and optimum combination of the spoken word, written word and the visual is necessary :

One can combine the spoken word with the written word, the written word with the picture word, or the picture word with the spoken word. Sometimes all the three may be used together. When we write or show written words while speaking, the spoken word is considered with the written word. When we explain with a chart, flannelgraph, exhibit, model, filmstrip or slides, we combine the picture word with the spoken word and so on.

The spoken and written words have an important disadvantage. If, the audience misses hearing some spoken words, or does not understand a few of the written words, the pictures or the images formed ir their mind will be blurred. Even if the words are spoken clearly and heard, if the listeners have not had enough time or have not paid enough attention, they will fail to form the picture in their minds. Hence we would always take the opportunity of supplementing the spoken word with the picture word or the visual.

A few useful facts :

1. Generally communication is more effective when more than one channel or media are used. i.e. when more senses are stimulated directly and immediately.

2. Whatever channel may be used, it has to be carefully selected and used in the right way, at the right time to do a right job with the right audience and all in relation to the right message. Any one of these being inconsistent, the message will have no meaning and creates 'noise' or obstructs communication.

3. No single medium is good for all messages, all audiences and for all times. It is a combination of media that produces the desired effect in a given situation and at a given time.

4. No single channel can reach all the people we want to reach, nor are all media suited to the abilities of all audiences. It we select the wrong channel or handle a right channel wrongly, we are in for disappointment.

5. About five to six channels used in a combination are often necessary to get the message through to a large audience with enough impact to influence significant changes in behaviour. If we select all media in the same series as for example, written materials only, like newspaper stories, leaflets and circular letters, the message does not effectively reach all the people. We should therefore, wisely use media which are parallel to each other - written media, spoken media and the picture media. This makes for good communication.

6. Messages need to be given to people in several media and at several times. A person does not normally get the information or learn at the very first exposure to a message. He should be exposed to it many times. Research has shown that 10 to 15 per cent of the people learn by reading, if the subject matter is expressed in simple and clear language; 20 to 25% learn by hearing, if they are attentive and the spoken word is interestingly put across; 30 to 35% per cent get the message by seeing a good visual material. 50% or more by seeing and hearing, if the two senses work together, and 90% if they are exposed to a multi-media mix or integrated media usage and if they can use all their senses.

Effectiveness of medium :

A medium may be effective in a given set of conditions, but may not be so under others. You cannot rely on one medium alone, however effective it may be, to create the needed impact. For instance, the radio imposes many conditions for its success as a medium of communication. The receiving set must be in working condition and be tuned into the right station at the right time. The listener should be at hand, with his mind tuned in to listening. There should be no distractions and the programme should have no interruptions or black-outs. Then and only then, the radio will have impact. If any one of these conditions is not fulfilled, the radio as a medium fails to do its job.

Effective media utilisation calls for thoughtful planning, correct decision making and scrupulous implementation. We have to use our imaginative approach, apply off–beat methods, breaking away from tradition, if necessary. A thorough check-up of the proposed plan and correct decisions which maximise the available resources are a must. Planning the work is as important as working the plan.

Conclusion :

1. Communicating useful information to all those who need it is not only an opportunity but also a challenge.

2. Planned programmes of education coupled with efficient and effective use of media can light candles for all our problems. And after all it is better to light a candle than to curse darkness.

Discussion

The following salient points were discussed :

1. Documentary films as a medium for nutrition education have to be fully exploited.
2. Film producers must be motivated to make commercial films based on agriculture and nutrition.
3. Rural radio broadcasts must build in more human interest element in their agricultural, nutrition programmes for impact.

Development and Demonstration of Education Aids for Nutrition

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Nutrition education is not the prerogative of one single discipline. It comes within the scope of all workers who are in direct contact with families or who are carrying out programmes in communities. It is a part of health education, home economics education, agricultural extension, social education and community development. Indeed, it is a part of basic education.

As Alan Holmes says, education is something quite different from simple teaching. It is not just a question of giving information to be memorised, it demands action and direct participation. This is true, because the objective of education is not only to pass on information but to provide a background from which ideas can be formed, a base from which to modify beliefs and attitudes and create new habits and behaviour.

A successful teacher requires particular personal qualities such as sincerity of purpose, a sense of humour and a pleasant manner. At the same time, he must understand the people he is educating, their cultural needs and ambitions and what it is that gives them the incentive to learn. He must also of course find a method of communication, a means of sharing his knowledge with people in a way they can understand, otherwise he can't help them.

Without communication, there can be no education.

Generally, the more senses people can use, the more likely they are to understand and to remember. It is for this reason that the teacher always does his best to devise ways of teaching which will enable the people to use as many of their senses as possible. He will talk to them, use recordings, show objects and make them do something.

There are two main types of aids used by teachers to assist them in their teaching and to help people to understand : *Audible aids* use, the sense of hearing and include the teacher's voice, radio, and tapes. *Visible aids* such as posters, pictures, books and pamphlets, which employ the sense of sight. These two are usually used in combination, generally known as *audio-visual aids*. But whether used singly or in combination, they must meet two requirements :

1. They must be easily understood by the people with whom they are used.
2. The ideas they help to teach must be acceptable or made acceptable to the group.

However, the most important thing one must remember is that the *aids* are intended to *aid* or help in teaching and to learn. If the materials do not do this, they cannot be called visual aids - and their use may even hinder learning.

It is also important to remember that an aid cannot normally teach by itself.

For instance posters are understood by people in technologically advanced countries because they already know the basic causes of diseases and the need for good - it only serves to remind them. Where there is no such knowledge a poster which says "Eat more vegetables" or "Drink milk everyday" just does not convey anything.

Factors influencing effectiveness of visual aids :

Whether a visual aid can help in understanding or act as a reminder, will depend upon whether the picture is recognized and understood. This in turn, depends upon several factors such as familiarity of objects depicted. Their scale and perceptual differences, colour employed, visual perception time, and the emphasis placed, i. e. whether positive or negative, and the timing of its application.

The aid needs constant evaluation for its efficacy. The educator must ensure that the talk and visual aids depicted what was intended and were not misinterpreted. The suitability of aid and its acceptability to the group must be ascertained. Did they make an impact ? Did they stimulate discussion ?

I. *Two Dimensional Aids as Reminders* :

The printed word is still the greatest and most widespread way of teaching people who can read and of influencing their opinions. Even when people cannot read by themselves, these papers and pamphlets are read out to

them by others. eg. in small tea-shops, in remote villages in Kerala and other states llke Tamil Nadu, it is quite common to see the village school teacher or other learned member reading the newspaper aloud for the benefit of others around.

Some examples of two dimensional aids are :

a) *Leaflets and handouts* are small sheets of paper with information printed, sometimes accompanied by photographs or illustrations and usually handed out in large number eg. Cinema advertisements, Food product advertisements etc.

b) *Booklets* are more expensive, are about twenty pages and not very big, illustrated appropriately with photos or pictures and are useful for adult literacy classes.

c) *Posters* must be big enough to be read from 3 metres distance and are good for passing brief but important messages to the literate public.

A poster has three requirements :

1. It must attract attention - bright and big.
2. It must hold the attention - humour, unusual, a wanted need mentioned etc.
3. It must promote action - appeals to emotions like envy, prestige, pride. If designed properly, it can remind people of what has been taught during an education campaign. They cannot teach by themselves.

d) *Wall charts and Flip charts* are variations of the above with more written matter and can be used in classrooms and places where people have more time to comprehend what is written. The same is true of pull charts and overlay charts.

e) *Flash cards* are a series of drawings, pictures or photographs which are shown one after another in the correct order to not more than 30 people at a time. This is good for step-by-step teaching. Other types are pi-diagrams, bar graphs, pictorial graphs, strip cartoons (6 to 12 pictures), print curtains, pop-up cards etc.

II. *Two Dimensional Aids involving active participation* :

a) *Chalk and talk* : This is a technique of teaching in which words and pictures are drawn on the chalkboard to illustrate points being made in

the talk. Unfortunately this technique does not work with illiterate groups and much depends upon the speaker's ability to write to draw clearly and quickly.

b) *Flannelgraph* : A hardboard covered by felt or flannel is used for placing flashcards with a rough surface on the back, to adhere to it. The advantage here is that as the story is developed the appropriate cards are stuck to its surface and finally the whole series is presented for the audience to see. When members of the audience are invited to put up a flash card, it arouses interest and curiosity and a sense of involvement. Plastographs and magnet boards are just variants of the above. The latter however are too heavy to be carried about.

c) Card game, snakes and ladders using dice, competitive games (colouring contests, picking out mistakes in a picture) puzzles can also be used.

III. *Three Dimensional Aids* :

The difficulty that some people have in recognizing unfamiliar objects is least, when they have length, breadth and depth.

a) *Real objects* are best for teaching nutrition, but vegetables and fruits tend to wilt fast and the ones needed most may not be available.

b) *Models* are good if life-like, with appropriate colours and can be made from various materials such as paper mache, plaster, clay, plastic, paper, metal etc. These are most useful for illiterate audiences.

c) *Exhibitions* are also good if planned carefully and devised to suit the group or community for which it is intended. It is the duty of the organizer to see that the idea is put across in an understandable and interesting way. As Alan Holmes says "the educational pill must be heavily coated with sugar".

IV. *Stories and plays* :

a) *Telling stories* or acting stories is part of the tradition of many countries eg. *Burrakatha, Harikatha* etc. Wandering story tellers still stop under the village tree to entertain people, and groups of strolling actors are still to be found. Both these are effective means of communication in nutrition education.

In a play, the actors enact a scene and get emotionally involved in the role that they are playing and carry the message to the audience most effectively. Short plays are more effective than long ones.

b) *Puppet shows* are most invaluable in nutrition education and are popular among women and children. There are various kinds of puppets– string, glove, rod puppets and controlled by the operators. If the members of a group write the play, make the puppets and produce and present it, they feel that it is their nutrition education. Humour is essential in this. The audience invariably gets involved in it and responds vigorously.

These have been used in India since times immemorial for enacting *Mahabharata* or *Ramayana* or *Krishna Leela* and are now being used sucessfully by Dr. Devadas and her group, in the rural areas around Coimbatore. In countries like Taiwan, Korea and Japan, spent cocoons are available and these are coloured appropriately and used on fingers as puppets.

V. *Photographs, Films, Pictures* :

a) The value of photographs as visual aids, as in the case of pictures, is based on several factors :

1. Familiarity of the object.
2. The angle and scale of the photographs.
3. The colours used.
4. Clarity of message.

b) Films as a visual aid in nutrition education is quite common and even in the remotest villages, people know what a cinema is and discuss it in detail. If feasible, this would be ideal to capture the attention of the audience for 20 or 30 minutes at a time. Selection of films involves the following principles.

1. The viewers must be shown familiar things eg. houses, food, clothes, animals, vegetation etc.
2. The picture and narration must be in a straight forward way - one main idea repeated in several interesting and varied ways.
3. The topic should not offend the audience in any way.
4. The speed of action must be suited to the level of understanding of the audience.
5. Timing of the show and the mood of the audience are two very important points to be remembered.

Short films with colour and music for entertainment can precede the basic film which can be shown after a brief introduction. A discussion can follow and questions answered particularly if the audience is used to seeing films. Film strips and slides also come under this category.

VI. *Mass media* :

Films, newspapers, T.V. and radio come under this category and are important aids in communicating with large number of people.

Now just to summarize the most important points when developing and using visual aids for nutrition education :

1. Find out what has been taught.
2. Consider the requirements for visual aids (listed previously) and decide which aids best help you to teach and the people to learn.
3. Decide on the best combination of aids, materials to be used and the lay-out design - posters, handouts etc.
4. Pre-test all your aids and refine them accordingly.
5. Evaluate the effect of visual aids on the people's learning and understanding. Use every means possible to do this.
6. From the results of the investigation, redesign or prepare new aids.
7. After a suitable interval, follow-up the effect of the programme with further effort.

Concluding, education is a slow process, changing behaviour is slower, and when the change concerns food habits, it may be slower still. Therefore, a nutrition educator who can select suitable means of bringing understanding to the people and by so doing, persuade them to adopt better food habits, will be rendering his country and his people a valuable service indeed.

Discussion

The following sailent points were discussed :

1. In our enthusiasm for exposure to media, the attention span of the target audience must not be overlooked.
2. More studies are required to fix the criteria for pretesting the aids in different situations and to different sizes of audiences.

Role of Home Science in Nutrition Education

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Nutrition education is a wide field. It covers right from the education of food policy makers down to acquiring tastes to include certain foods in the daily diet. If correct foods are not produced or acquired and made available to the people, there is no point in trying to persuade consumers to include these nutritious items in the diet. Producing adequate food of good nutritional quality and making it available to people is a government responsibility. Such responsibility is well recognised in developed countries and the food policy planning includes detailed discussions on the nutritional aspects of food production, storage, marketing and preservation. These governments, after obtaining scientific advice on nutrition, decide on the labelling, pricing and marketing of certain products. In the developing countries, it is not always possible for the government to base the production and movement of food on nutritional considerations. Food transport also adds to the price of the food and frequently the flow of food is based on purchasing capacity and/or political considerations rather than need.

Nutrition education is thus required at many levels and categories of people, such as :

1. Policy makers : Governmental and other national leaders as well as price setters.
2. Food producers and manufacturers such as farmers, biscuit manufacturers as well as local food manufacturers such as *Halwais*.
3. Agencies and people involved in food distribution and service : these include food canteens in factories and offices involved in food distribution.
4. Consumers (Home makers), Home Scientists.

Consumer Education programme :

The home scientist can play a vital role in imparting nutrition education to these groups, particularly the consumers who are usually the home makers. Once the consumers are made aware, they can themselves educate the other groups. A home scientist, particularly as a practising housewife, is a consumer and a very important link in the chain of nutrition education. Therefore, the first step in the role of the home scientist is nutrition education of the consumers or the home makers who in turn can have a bearing on other groups. The consumer is concerned with :

(a) Procurement of food

(b) Storage of food for shorter and longer durations

(c) Preparation of food

(d) Distribution of food according to individual needs of the group.

(e) Food hygiene

Procurement of Food :

Nutrition education programme has therefore to concern itself with providing information on what is the cheapest method to meet nutrient requirements. Consumers may be procuring the food material based on non nutritional considerations. In order to impart nutrition education to consumers, cost/nutrition ratios or "indices" need to be developed and published regularly so that consumers may know how best to meet their nutrient requirements. Such indices also give due importance to the nutrient content of a food (Tables 1, 2, 3).

Although taste, quality and price are the important factors in the purchase of food, nutrient content weighed against the price is vital in choosing correct foods. From these indices one can determine the contribution of foods in terms of specific nutrients. These indices can also aid in identifying those foods which contribute more than one nutrient. Such knowledge is effective in guiding the consumers to take up matters with policy makers for providing foods such as milk at subsidised prices. The price - nutrient indices can also be used to formulate and list low cost balanced diets. Regular printing and publishing of low cost nutritious recipes can aid cafetarias as well as families. Furthermore, they can be used by employers for fixing minimum wages whereby the wages can be expected to provide at least balanced nutritious meals to all workers. These lists can be used to aid food payments in " Food for Work" programmes.

TABLE 1

Nutrients derived from food at market price (1977–78) per rupee expenditure

Sr. No.	Source	Qty. of source (g)	Energy (K. cal)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (I. U)	Thiamine (mg)	Niacin (mg)	Vitamin C (mg)	PUFA* content (g)
1.	Wheat	910	3167	107	455	48.2	983.0	4.9	50.0	—	—
2.	Rice	870	3001	59	87	27.0	—	0.5	16.53	—	—
3.	Maize	770	2880	85	385	29.3	—	4.2	8.5	—	—
4.	Bajra	870	3132	101	435	76.5	739.5	2.9	20.0	—	—
5.	Gram dhal	625	2372	130	350	56.9	1350	3.0	15.0	6.25	—
6.	Milk (cows)	500	335	16	600	1.0	870	0.25	0.5	10.0	—
7.	Milk (buffaloes)	416	487	18	873	0.83	667	0.17	0.1	4.2	—
8.	Egg	125	216	17	75	2.6	1500	0.125	0.125	—	—
9.	Chicken	83	86	21.5	21	—	—	—	—	—	—
10.	Goat (meat)	100	118	21	12.0	—	—	—	—	—	—
11.	Apple	250	140	0.5	25.0	2.5	—	—	—	2.5	—
12.	Guava	500	255	4.5	50.0	7.0	—	0.15	2.0	1060.0	—
13.	Orange	300	144	2.0	78	1.0	5400	—	—	90.0	—
14.	Banana	500	580	6.0	85	4.5	130	0.25	2.5	35.0	—
15.	Ber	500									
16.	Grapes	333	234	1.6	66	1.7	—	—	—	3.3	—
17.	Lemon	200	114	2.0	140	4.6	—	—	—	78.0	—

18.	Potato	1000	970	16.0	100	2.0	400	—	—	170.0	—
19.	Tomatoes	1000	200	9.0	480	—	5850	—	—	270.0	—
20.	Onions	1250	750	22.5	225	—	—	—	—	—	—
21.	Brinjals	2200	508	31	26	176	275	—	—	27.0	—
22.	Carrots	1660	3984	15	167	3.60	5250	—	—	270.0	—
23.	Palak	2000	520	40	146	29.0	18600	—	—	56.0	—
24.	Sugar	235	905	—	—	—	—	—	—	—	—
25.	Sugar **	470	1810	—	—	—	—	—	—	—	—
26.	Jaggery	625	2394	2.5	500	71.0	1050	—	—	—	—
27.	*Desi* Ghee (Butter fat)	37.0	333	—	—	—	333	—	—	—	0.74
28.	Groundnut oil	71.0	639	—	—	—	—	—	—	—	19.88
29.	Mustard oil	100.0	900	—	—	—	—	—	—	—	20.00
30.	Dalda (vanaspathi)	91.0	819	—	—	—	2275	—	—	—	5.46
31.	Sunflower oil	63.0	567	—	—	—	—	—	—	—	45.25

* PUFA – means polyunsaturated fatty acids.

** Sugar available at controlled rate.

TABLE 2

Nutrient yield per acre from various food constituents

Sr. No.	Source	Yield (Q/a)	Cost of production (Rs/a)	Energy 1000 Kcal	Protein (kg)	Calcium (g)	Iron (g)	Vitamin A 1000 I.U.	Thiamine (mg)	Niacin (mg)	Vitamin C (g)	PUFA (g)
1.	Wheat	17	1360	5916	200.0	850	29.0	1836	9180	85000	—	—
2.	Rice	25	1275	5916	120.7	170	47.6	—	1870	17000	—	—
3.	Maize	16	1312	5984	177.6	800	60.8	—	8640	17600	—	—
4.	Bajra	13	1265	4680	150.8	650	114.4	1105	4290	29900	—	—
5.	Gram dha l	3.5		1302	72.8	196	31.8	756	1680	8400	3.5	—
6.	Apples	350	—	19600	315.0	3500	595.0	—	10500	70000	11.3	—
7.	Guava	22	—	1452	33.0	220	22.0	572	440	22000	14.6	—
8.	Orange	75	11250	3000	67.5	750	30.0	159	3000	15000	3450.0	—
9.	Banana	500	—	57375	487.5	3750	150.0	—	15000	113500	375.0	—
10.	Ber	65	1250									
11.	Grapes	45	2250	3195	12.5	900	67.5	—	—	—	45.0	—
12.	Lemon	17	900	595	11.9	510	11.9	—	—	—	765.0	—
13.	Potato	80	1500	7760	128.0	800	16.0	3200	—	—	1360.0	—
14.	Tomato	160	1500	320	14.40	7880	—	93600	—	—	4320.0	—
15.	Onions	120	1200	720	21.00	2500	—	—	—	—	—	—
16.	Brinjals	160	1000	384	22.40	4016	2816.0	4400	—	—	432.0	—
17.	Carrots	150	1005	720	13.50	2505	54	78750	—	—	45.0	—
18.	Palak	160	800	312	24.00	2436	352	298	—	—	896.0	—
19.	Groundnut	8.9	945	39	—	—	—	—	—	—	—	1220
20.	Mustard	5.8	678	20	—	—	—	—	—	—	—	444
21.	Sunflower	4.0	1080	17	—	—	—	—	—	—	—	1331

TABLE 3

Vitamins and minerals obtained at per rupee cost from vegetables

Source	Vitamins		Minerals	
	Vit. A I. U.	Vit. C (mg)	Calcium (mg)	Iron (mg)
Tomatoes	5850	270	480	
Onions			225	
Brinjals	275	27	26	176.00
Carrots	5250	5	167	3.60
Palak	18600	56	146	29.00

Calories, proteins and minerals derived from different sources at market price per rupee of expenditure

Sr. No.	Source	Quantity of source (gm)	Calories (Kcal)	Protein (gm)	Minerals (gm)
1.	Gram dhal	625	2372	13.0	16.87
2. (a)	Milk (cow)	500	335	16.0	4.00
(b)	Milk (buffalo)	416	487	17.9	3.33
3.	Egg	125	216	16.6	1.25
4.	Chicken	83	86	21.5	1.07
5.	Goat	100	118	21.4	1.1

In addition to price and nutrition considerations in food procurement, attention has to be given to quality and hygienic factors. For instance, food quality relates to freshness, the absence of toxic materials in the form of insecticides, manure contamination and other factors. Information has to be gathered, quality maintained and proper education given to consumers as well as policy planners on the safety of foods in term of hygiene and toxic factors. Contamination can also refer to intentional mixing of ingredients other than the stated food material, such as adulteration of fats, oils and spices.

Storage of Food :

The home scientist can play an important role in educating the consumers on the correct methods of food storage. Foods which are both perishable and non perishable can be stored effectively. Depending on the space available, the consumer can bulk purchase grains for safe storage. He can preserve foods in times of abundance for later use. In general, preservation of food unless intelligently done, is rarely an economic proposition. The stored food has to be maintained in terms of quality (nutrition as well as other factors). Sun drying and other cheap forms of preservation can be used effectively and economically in a country with abundant sunshine, particularly in places with dry weather.

Preparation of food :

The first image that springs to the mind when thinking of a home scientist/nutritionist is one of cooking food. No doubt, the correct combination of food materials in the form of a recipe/meal to present a nutritional balance is the goal of a nutritionist. While formulating recipes/diets it is rare that nutritional combinations are sought. It is the duty of the nutrition educator to study the local recipes/diets and grade them in terms of nutrition. Those local recipes, which can be enriched with the addition of other food materials, can be used for educating people in enriching their diets. Correct methods of cooking food to conserve nutrients and food quality is an important matter for consideration by the home scientist (Table 4).

Information on the nutrition quality of cooked Indian foods has to be generated and then disseminated. The preparation and utilization of some materials needs to be encouraged through education. For instance potatoes which can easily be grown in abundance in Punjab are used as a vegetable. Since people do not know their preparation and use as a good crop, education in nutritionally balancing recipes of potatoes to encourage its use during the season can bring an important, easy-to-grow food material to use.

Distribution of food :

Within the family it is important that food should be distributed according to the needs of individual family members. Our studies have shown this to be of particular importance with regard to certain foods which are expensive. Attention should be given to the correct distribution of protein-rich or generally nutritious foods such as milk, eggs as well as energy rich foods. It is obvious that fats and oils are important sources of concentrated energy and tend to be lacking in most Indian diets; for which reason most Indian diets

do not provide adequate energy. The correct distribution of food also includes care of the nutritional requirements of nursing and pregnant women.

Food Hygiene :

No programme of nutrition education can be complete without education on food hygiene. The health and hygiene of people whether they be housewives, hotel cooks or domestic servants is important to maintain cleanliness of food. The larger the population served by these people, the more crucial is the maintenance of health and hygiene standards of personnel involved in food preparation. Education is required at all levels to ensure clean food.

Education Programme - How to convey :

The technical information that needs to be disseminated can reach its goal only if correct methods are employed in transferring it. Success in the transfer of technical knowledge is dependent on selection of correct methods of education. Consumers or housewives are not in the habit of listening to academic monologues/discussions or lengthy lectures whether they be on the radio, television or in the cinema. Articles, pamphlets and published material can also reach only a fraction of the consumers. The author is struck by the absence of entertaining/interesting material for under - educated or illiterate consumers. Radio programme meant for villagers rarely invite the consumers themselves for their comments or participation. So many such programmes remain sterile and are not based on the requirements.

There is a need to develop programmes, test and disseminate them in the form of family entertainment on the radio and television where these facilities exist. Films can be used effectively but entertaining cum educational films are absent.

Indigenous methods have a wide scope (eg. Rakhee, Gyan Mala, Fans) and can be developed. Use of regional festivals and *melas* for education cannot be overemphasized.

The educational Material

While a home scientist can select the information and methods, the preparation of meterial/programme (TV, films, publication) is highly technical and needs specialists. In our work on preparing material we have often wished for being backed by a good publisher, illustrator, videotaping, qualified dramatic personnel and for help in musical setting, direction facilities, film production and preparation of animated films for women and children on

entertaining educational subjects. Obviously these technically developed fields require specialists. Currently the film, TV, radio and publication specialists are working without technical aid of subject matter specialist. In this case a reverse method can be utilized whereby consultancy service of adequately qualified nutitionists can be made available to the people incharge of preparing programmes that reach people.

The type of educational material will be as varied as the people for whom it is intended.

1. Material for policy makers : People in these positions may not have much time at their disposal. This group is usually literate. The material used to bring crucial nutritional facts to their notice can take the form of well presented cards on nutrition and health. These cards can be distributed through post. aircraft and trains where most such people travel.

2. Material for children : This can be in the form of games, quizzes, dramas or poems. This can be presented through newspapers, schools or crafts classes in the villages where children can prepare their own material.

3. Material for farmers: Educational material for farmers can be in the form of radio or TV programmes that entertain and educate simultaneously. The farmer needs be told what foods he can grow at least for use of his own family.

4. *Material for women*: This material can be in the form of radio, TV programs, films or printed material. Short training programs, 'do it yourself' guides are also valuable. Neighbour education programmes whereby educated neighbours after educating or attending courses can be presented with material on how to educate their neighbours. Locality competition organisations can also be suggested.

5. *Material for special groups* : Older people, pregnant, nursing mothers, rickshawpullers, labourers etc. require treatment according to their need.

6. *Nutrition during sickness* : Material regarding nutrition under conditions of sickness as well as diseases requiring special diets has to be prepared for all levels. It can be in the printed form, or as Out-Patient Programme in the hospitals. Radio and TV programmes could cover this area when special diseases such as hepatitis or gastroenteritis become epidemic.

In conclusion, it can be stated that home science can be an effective cog in the machinery of nutrition education and that whole machinery of nutrition education requires overhauling and smooth functioning for effectiveness.

TABLE 4.

Recommended Nutritional Improvements

I. Normal family diet :

Food consumed	Additions (locally available foodstuffs)	Additional Nutrients.
1. Curds	i) Leafy vegetables	i) Iron, vit. C
	ii) Carrot, pumpkin	ii) Vit. A
	iii) Brinjal	iii) Iron
	iv) Cucumber	iv) Vit. B complex
	v) Dal wadae	v) Proteins
	vi) Tomatoes	vi) Vit. C
	vii) Banana or grapes	vii) Carbohydrate, Vit. C
2. Biscuits	i) Soybean or peanut flour	i) Proteins
	ii) Green leafy veg. (dried)	ii) Iron, Vit. C
	iii) Jaggery instead of sugar	iii) Iron
	iv) Besan	iv) Proteins
	v) Peanut or til seeds	v) Proteins
	vi) Boiled, chopped potatoes	vi) Starch
3. Dals	i) Two or three dals	i) Protein quality improved
	ii) Sprouted dal	ii) Vit. C
	iii) Whey can be put in dal instead of water	iii) Protein quality improved
4. Roti	i) Besan or leftover dal can be mixed with the wheat flour	i) Protein quality improved
	ii) Green leafy vegetables and grated carrots can be added to the wheat flour	ii) Iron and Vit. C and Vit. A
	iii) Grated radish	iii) Minerals
	iv) Peanut or soy flour	iv) Proteins
5. Vegetables	i) Peanuts, til seeds & dal can be added in the vegetables	i) Protein quality improved
	ii) Mint chutney can be given	ii) Rich source of Vit. C and A
6. Gur	i) Peanuts & coconuts, seeds of melon, til seeds can be added while making gur.	i) Protein quality improved.

Food consumed	Additions (locally available foodstuffs)	Additional Nutrients
II. Special foods for Pregnancy and Lactation		
Panjeeri	i) Peanut flour, soya flour or besan	i) Protein quality improved.
	ii) Peanuts instead of almonds	
III. School Lunch Packages		
1. Parantha	i) Green leafy vegetables	i) Iron & Vit. C
	ii) Carrots	ii) Vit. A
	iii) Soyflour or peanut flour	iii) Protein quality improved
	iv) Dal	iv) Protein quality improved
2. Jam and Chutney	i) Carrot	i) Vit. A
IV. Beverage		
1. Lemon juice	Mint	Vit. A and C
2. Lassi	Mangoes, papaya, banana	Vit. A, carbohydrates
3. Milk	Mangoes, bananas, papaya	Vit. A, carbohydrates
4. Tomatoes	Tomato juice & jaggery	Vit. C, Iron
5. Phalsa	Phalsa juice & jaggery	Vit. A and C
6. Satoo drink	Satoo & jaggery	Carbohydrates, iron
7. Soup	Vegetables, dal & black channa soup	Proteins, iron and Vit. B. complex,
8. Whey water	Whey water & Jaggery	Proteins, iron
V. Sweet dishes		
1. Dalia	Jaggery, peanuts	Iron and protein
2. Kheer	i) Sago kheer with jaggery	Iron
	ii) Suji kheer with jaggery	Iron
	iii) Ghia, pumpkin or cauliflower kheer	Vit. B. complex, Vit. A
3. Halwa	i) Besan	Proteins
	ii) Moong dal or channa dal	Proteins
	iii) Soy flour or peanut flour	Proteins
	iv) Jaggery instead of sugar	Iron
4. Sevian	i) Jaggery instead of sugar	Iron
	ii) Chopped peanuts	Proteins

Food consumed	Additions (locally available foodstuffs)	Additional Nutrients.
VI. Snacks	*Additions or Modifications*	
1. Burfi	i) Besan	Proteins
	ii) Chopped peanuts	Proteins
	iii) Til seeds	Proteins
	iv) Jaggery instead of sugar	Iron
2. Chikki	i) Peanuts	Proteins
	ii) Channa dal	Proteins
	iii) Seeds	Proteins
	iv) Puffed rice	Starch
3. Laddu	i) Soy flour or peanut flour	Proteins
	ii) Peanuts chopped	Proteins
	iii) Til seeds	Proteins
	iv) Besan	Proteins
	v) Jaggery	Iron
4. Shakarpara	i) Besan	Proteins
	ii) Til seeds	Proteins
	iii) Peanut flour or soy flour	Proteins
	iv) Jaggery	Iron
5. Mathi (salty and sweet)	i) Spinach	Vit. A and C
	ii) Soy flour or peanut flour	Proteins
	iii) Til seeds	Proteins
	iv) Jaggery	Iron
6. Pulses	i) Sprouting	Vitamin C
7. Pan-cakes (salty and sweet)	i) Rice flour	Starch
	ii) Besan	Proteins
	iii) Green leafy vegetables	Vit. A and C
	iv) Jaggery instead of sugar.	Iron
VII. Cooking Practices	*Additions or Modifications*	*The outcome or aftereffect*
1. Washing	i) Should be washed before cutting (vegetables)	Avoids loss of nutrients i. e. soluble minerals and vitamins.
	ii) Should be given minimnm washings.	
2. Soaking water	Used in cooking	Preserves nutrients
3. Cooking	Either covered pan or pressure cooker.	Preserves more of nutrients than the open pan cooking.

4. Cooking time	Only till cooked, do not over-cook	Saves fuel, as well as preserves nutrients.
VIII. Infant feeding		
1. Breast feeding	Breast milk maximum till one year	The normal practice of feeding up to 2 to 3 yrs. which has adverse effect on mother's health and at the same time the child's needs not be fulfilled.
2. Artificial feeding.	Artificial foods. More emphasis on cow or buffalo milk and not on baby and tinned or commercial foods.	Fresh, easily available cheap and satisfies the needs of a child.
3. *Supplementation*		
(a) Liquids	Foods in addition to milk should be started at the age of 6 months, especially iron and vitamin rich foods should be added.	As milk is lacking in these two nutrients.
(b) Solid food	Solid foods like dal, curd, porridge, khichri, mashed fruits and vegetables should be progressively included.	Satisfies nutritional needs.
IX. Pregnancy and Lactation		
Increased intake	Protective foods, vegetables milk and milk products.	Better health of the mother and child.
X. Old age	Less intake of food	Decreased needs
XI. Disease conditions	In fever conditions more of easily digested diet should be given along with milk.	Increased needs.
XII. Preservation	Vegetables and fruits in the form of chutney, jam and murabba.	More variety and better use of surplus food.
XIII. Storage	By sun-drying ; use of plastic bags ; application of oil, haldi, salt etc. to pulses.	Use in off season and more variety.

Discussion

The following salient points were discussed :

1. The expertise of advertising agencies in persuasive communication must be utilised in campaigns of nutrition education.

2. Hospital out-patient situation must be exploited for effective nutrition/ health education since the target will be receptive to advice on preventive health care.

3. Organising active listeners, clubs enhances the efficiency of health and nutrition based radio broadcasts.

SESSION - IV

Thursday, July 24, 1980

Chairman : **Dr. (Mrs) P. Pushpamma**
Dean
College of Home Science
Andhra Pradesh Agricultural University
Hyderabad

Rapporteur : **Mrs. Parvathi Rau**
Field Officer
National Institute of Nutrition
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Nutrition Education Through Different Community Level Workers

Dr. M. C. Swaminathan
Deputy Director
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The need for health and nutrition education of communities along with other nutrition intervention programmes like supplementary feeding etc., has been highlighted by several studies in India and elsewhere. However, for the last two decades, educational aspects have neither been stressed nor implemented properly in almost all nutrition intervention programmes, including those like the Applied Nutrition Programme in our country.

Currently, nutrition education is largely conducted by the limited staff of the health services or by other agencies involved such as the Department of Community Development through specific programmes like Applied Nutrition Programme or through the Department of Education, to school children.

Table-1 presents the programmes and agencies which undertake nutrition education in the nutrition programmes currently in operation. It is clear that different kinds of personnel are, at present, involved to deliver nutrition education to the community in general, as well as to specific groups of population like the women, pre-school and school children. From the experiences of these programmes, it can be stated that with the possible exception of school children, the coverage under nutrition education has been rather poor. Also, no systematic approach has so far been made to improve the situation. The reason for this could be the poor coverage of nutrition programmes (of which nutrition education is a component) in terms of population, and lack of well-trained, motivated workers.

Recently, the implementation of Community Health Volunteer (CHV) Scheme has opened up the possibility of utilising these community workers for extending the existing coverage of nutrition services including nutrition education to the community. Ideally, a nutrition educator should be a 'local

person' familiar with the characteristics of the local population and its environment, be acceptable to all segments of the community and have 'service' as a motto. He/ she should, of course, be trained adequately in nutrition and health aspects. When these criteria are taken into account, only a few selected individuals can serve as Nutrition Educators at the village level. These could be: the school teacher, community health volunteer or members of organised groups like youth clubs and women clubs. In the category of health workers, are the male and female health workers of the Primary Health Centre and also the traditional birth attendant (*Dai*).

The attributes of an ideal community health educator and the extent to which the different kinds of local community workers satisfy these, are illustrated in Table-2. It is obvious that the health workers and school teacher are ideally suited as community health educators. However, on the basis of their availability and the coverage of the community, the services of other members like Community Health Volunteer or members of the social or youth club etc., may have to be considered. The traditional birth attendant (*Dai*) is also useful, particularly in the case of women and children. However, her knowledge of health and nutrition is still primitive and until we have trained-*Dais*, it may not be appropriate to use their services for active nutrition education.

Table 3 gives the knowledge and practice with respect to nutrition by different kinds of workers. The health workers naturally possessed the best knowledge and can be expected to practise nutrition knowledge better than the other groups of workers. The next best group for the purpose of nutrition education appears to be workers from the Department of Women and Child Welfare and the Community Health Volunteers.

Considering the various aspects mentioned above, such as knowledge, practice, availability, coverage, acceptance by the community, etc. it would appear that the community health volunteer who is being trained to deliver basic health services to the community would be ideally suited for advising the community on matters of health and nutrition.

In a recent study carried out on Community Health Volunteers by the National Institute of Nutrition in Andhra Pradesh, it was observed that the knowledge on nutrition possessed by the Community Health Volunteers, who were trained by the local health staff, did not always relate to local conditions and invariably reflected the text book education of nutritional problems and their prevention. In their practice also, Community Health Volunteers were

not able to deliver nutrition services except for providing some help to the health staff in immunisation and distribution of nutrients like vitamin A and iron and folic acid. However, their main activity was to provide drugs for treatment of minor ailments which was the felt need of the community.

It is concluded that, considering the poor availability of services to needy sections of the population in our rural areas in relation to health and nutrition due to various reasons, the community health volunteer would be a potential worker for the delivery of health and nutrition services particularly health and nutrition education.

However, before involving the Community Health Volunteers in large scale nutrition education efforts, proper planning is essential and adequate steps should be taken to provide them appropriate training and necessary aids for the purpose.

TABLE 1

Nutrition Education in Current Programmes

	Programme	Agency	Personnel	Location	Main target
1.	Applied Nutrition Programme	Rural Development	Gram Sevika/ Mukhya Sevika, Extension staff of Community Development Block	Community	Women
2.	Mobile Food and Nutrition Extension Service	Department of Food	Special staff/ Experts	Community	Women
3.	Integrated Child Development Services	Department of Social Welfare.	Anganwadi Workers.	Anganwadi	Pre-school child/ Women
4.	Balwadi	Department of Women Welfare	Balsevika	Balwadi	Pre-school children
5.	Rural Programmes	All India Radio/ Door Darshan Kendra	Staff/ Experts	—	Community
6.	Rural Health Services	Department of Health	Health Workers	Community	Community
7.	School Health Services	Department of Education	School Teacher	School	School Children

TABLE 2

Relative Merits of Community Health Educators

Attributes	School Teacher	Community Health Volunteer	Members of Social Group/ Youth Club/ Women Club	Dai	Health Workers
1. Local	±	+	+	+	±
2. Contacts with all segments	+	±	±	+	+
3. Acceptable to the Community	+	±	+	+	+
4. Availability of time	—	+	+	±	±
5. "Motto" of Service	±	+	+	±	±
6. Knowledge (Health and Nutrition)	±	±	—	±	+
7. Capacity/Opportunity					
(a) To understand knowledge (training)	+	±	±	±	+
(b) To transmit knowledge	+	±	+	+	+

+ Present ± May or may not be present — Not present

TABLE 3

Knowledge and Practice of Nutrition by Community Health Educators

Aspects	Health Workers	School Teacher	Women and child welfare staff	Dai	Community Workers	
					Community Health Volunteer	Youth Club/ Women Club member
Identification of Nutrition disorders	++/+++	—	—	—	±	—
Growth and Development of Children/ Anthropometry	++	±	—	±	—	—
Management of Nutrition disorders/Dietary advice	++	—	±	—	—	—
Nutritive Value of Foods	++	±	+	—	±	—
Nutritional Requirements of various groups.	++	—	—	—	—	—
Utilisation of local food resources	+	—	++	—	—	—

+++ Good ++ Fair + Poor — Nil

Discussion

The following salient points were discussed :

1. Though the CHV is dispensing drugs, we must ensure that he does not think of himself as a doctor but realise his status as just a health educator.

2. The decision on choice of the worker must be based on specific local situation and not generalised.

Role of Voluntary Agencies in Nutrition Education

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Although lack of purchasing power is a major constraint in fulfilling nutritional requirements, the magnitude of many nutritional deficiencies would be lessened if people use the available resources better. This would be particularly true in the case of preschool child malnutrition where the problem is one of inadequate knowledge of parents regarding the need of the child and not of spending more. The objective of nutrition education therefore is to make people recognize the problem of malnutrition and assist them to solve it by persuading them to modify existing dietary practices within the resources available to them. By increasing the capability of people to fulfil the nutritional needs of their children through what is available at home, nutrition education offers a permanent solution to reducing malnutrition caused by ignorance.

Voluntary Agencies and Nutrition Education :

Due to some of their inherent features, and their historical involvement in supplementary feeding and other health programmes which are directly related to nutrition education, voluntary agencies are in a position to contribute a great deal to nutrition education.

The flexibility to respond to changing situations, a capacity to experiment with innovative approaches even at the risk of failure and the absence of organizational inheritance from which it may be difficult to break away - these are the qualities that make voluntary agencies especially suited to involvement in nutrition education. The mode of working of voluntary agencies also allows them to cut across heirarchies and operate at various levels of functionaries, with different agencies and through several channels. They are thus endowed with a degree of freedom of operation demanded by any large scale educational effort.

Involvement in Related Programmes :

In India, voluntary agencies at the national and village level have a long tradition of successful involvement in nutrition and health programmes. They have an established base in these programmes and an extensive field outreach. Both these facilitate in the conduct of nutrition education programme at a minimum additional cost. CARE's experience in nutrition education during the past several years has led us to believe that nutrition education, if integrated with supplementary feeding and health programme has a greater chance of success than if attempted in isolation. Given that resources available are scarce, nutrition education would have a better chance of being implemented on a large scale if operated through the existing physical and personnel infrastructure.

Moreover, since dietary habits are closely related to the customs and traditional beliefs of people, advocating a change in habits requires constant touch with the target group. This can be done by voluntary agencies already at work at the grass roots level.

Voluntary agencies are operating at two levels in the country. One group constitutes the associations functioning at the village level such as Mahila Mandals, Rama Krishna Mission, ICCW, Christian Missions etc The other includes the agencies functioning at the state level or national level such as CARE, VHAI and so on. Because of their close contact with the community, the village level agencies would be appropriately equipped to conduct the actual operations of a nutrition education programme. These in turn could be supported by the national level agencies in terms of funds media and training facilities. The latter could also coordinate various activities of the village level agencies and act as a link between them and the Government.

Current Involvement of Voluntary Agencies in Nutrition Education :

Several programmes are being operated by different agencies all over the country as described by some other speakers. But these are widely scattered and cover very small groups of population. At the present rate, it might take decades for messages to reach an appreciable number of people, let alone bring about change in habits. In such situations, voluntary agencies need to supplement the governmental efforts in nutrition education by working at a much larger scale than is being done at present. Three current programmes which are being implemented by CARE and the host State Government are described below.

a. *The Modified Special Nutrition Programme* is going on in the urban slums of several municipalities of Tamil Nadu, and offers a package of "take home"[2] food, curative and preventive health services and nutrition education to pre-school children and their mothers through MCH centres. The nutrition education component is handled by 48 specially trained extension educators. They conduct home visits and group meetings at which specific nutrition related messages are disseminated with the help of visual aids. The interpersonal contacts are reinforced by mass media such as film shows, theatre shows using folk entertainment methods and radio dramas broadcast on All India Radio, Madras.

b. *The Integrated Child Health Scheme* in Calcutta city, is operating through 30 *balwadi cum creche* centres established for children in the age group 6 months to six years where an integrated package of services is offered. CARE and the Rama Krisbna Mission administer the program with assistance from the Government of West Bengal. The balsevikas are the functionaries in this programme who, along with their other duties, are responsible for carrying out nutrition education for mothers. Growth Chart is the primary tool used for educating mothers on better child care. Healthy baby contests, exhibitions and slide/film shows are also employed.

c. *Composite Programme for Women and Preschool Children* is a rural *balwadi* programme in Kerala. Its most important feature is the involvement of the village level voluntary agency, the Mahila Samajams. With the initiative and active interest of the members of the Mahila Samajam nutrition education has become a vital part of the programme. CARE and the Government of Kerala support the Mahila Samajams to organize nutrition camps for village women, set up exhibitions, hold group meetings and communicate messages using mass media.

Future Role of Voluntary Agencies in Nutrition Education:

a. *Experimentation.*

As opposed to the governmental agencies, voluntary agencies are in an advantageous position to test innovative approaches even at the risk of not succeeding. Much is yet to be learnt about the most effective method of nutrition education and the comparative impact of different approaches. The cost effectiveness of nutrition education as compared to other interventions dealing with malnutrition is also to be determined. Voluntary agencies could get involved with these aspects.

b. *Evaluation of Nutrition Education Programme.*

Simultaneous with the launching of a nutrition education programme, steps need to be taken to collect data to evaluate the result of the efforts made. In the past, nutrition education programmes have seldom been evaluated for their impact. In the absence of evaluation we cannot be sure if the limited resources on hand are being utilised properly for the accomplishment of the goal of modifying food habits. The various approaches used in nutrition education also need to be evaluated to determine the merits and demerits of each, make mid course correction and decide the course of future action. Voluntary agencies could take up such evaluations and then assist in formulating policies for nutrition education programme.

c. *Effectiveness of Mass Media*

Voluntary agencies have contributed a great deal towards the production of material using mass media and audio visual aids. At present much material is produced in different languages and on different subjects and is being used all over the country.

It is time that before any more efforts are made in this direction, we assess the comparative effectiveness of the different media in communicating the intended messages and determine the media mixes that would be appropriate for different situations.

An exercise was attempted by CARE in Tamil Nadu some time ago to test the effectiveness of all media produced to date in transmitting messages. Almost 900 respondents were interviewed to assess three attributes of the media –noticeability, retention and recall. Among the different media tested, posters and comics received the lowest scores for all attributes. Filmstrips could have had the desired effect if they had been used more frequently and if the messages were confined to few. All films scored very well for all attributes. Short films in particular scored more than the long films, mainly because the number of sub-messages communicated in a short film were less. Magic shows, puppet shows and radio dramas were rated high although it was found that impact would be more if all show timings were limited to 30 minutes and confined to specific themes.

It was amply proved by the study that all media may not prove to be successful under all conditions and that it is not only important to produce the material and utilize it but also to obtain feedback from the community

about the utility of the media. It also helped in determining future plans for media production.

d. Training of Functionaries

Voluntary agencies could help to locate and train nutrition extension workers from villages and supervise their work. The nutrition extension worker could be a feeding programme organizer, a paramedical, a *balsevika*, a *dai* or a local leader.

Discussion

The following salient points were discussed :

1. The activity of the several voluntary agencies must be complementary and not competitive or tend to overlap, resulting in dissipation of resources.

2. Some more attention must be given to collection of base-line information regarding the community before sinking the inputs.

Concluding Session

Thursday, July 24, 1980

The delegates felt that the deliberations of the Workshop on Nutrition Education had indicated several important pointers.

Need for nutrition education has been long felt and attempts in that direction have been in existence for over two decades. But education components of health/nutrition programmes have failed to make an impact, while on the food production front considerable advances have been made. Past mistakes made in the matters of planning, methods of implementation and evaluation need to be rectified We have to refine our tools of education making use of modern concepts of communication.

Formal, institutional type of nutrition education (Colleges of Home Science, Agricultural Universities, Medical Colleges, Training Institutions) must continue. These institutions must provide training support utilising research resources. Nutrition education must be taken up in all seriousness from primary school level upwards.

Voluntary agencies have a great role to play. This has been amply made clear by experiments in agricultural extension at Kosbad and in health delivery systems at Jamkhed.

Scientists must provide the policy maker specific, unambiguous, non-contradictory information based on facts to facilitate administrative action in the right direction. This input can contribute to the fulfilment of the common goal namely improvement of the quality of life of the people. Nutrition educators must learn to be effective nutrition communicators. A blend of all available media must be put in use depending on situations. Continuous search should be on for pinpointing appropriate extension functionaries at the grass root level.

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